LESSONS IN PROJECT MANAGEMENT

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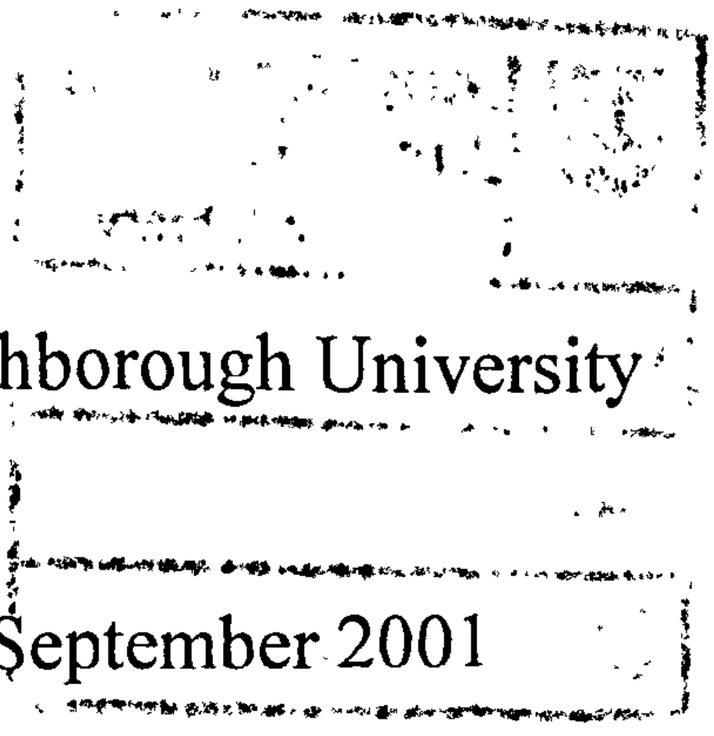
A Doctoral Thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy



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My research findings suggest that part-time and in particular distance learning rely on personal discipline and commitment. This may be valid, but it is undoubtedly true that without the support of my family I should not have completed this work. Thanks Mum, Dad, Peter, Alison, Myra and my darling wife, Rona - how you have put up with me these past five years is beyond me!

To

Edward and Rory

Love

Dad

xxx

ABSTRACT

The conventional view of project management is challenged by a contemporary construction industry that is rethinking its processes and procedures as it seeks to align itself with clients' business needs. Project managers must update their skills. They require flexible education and training that complements work place experience rather than distracts from professional obligations. Educational technology offers an exciting opportunity to accommodate these, often conflicting, requirements. Computer-aided learning (CAL) is supported by a government keen to promote a Learning Society, the expansion of Higher Education (HE) postgraduate provision and the construction industry's own initiatives to engender a culture of lifelong learning. Enthusiasts argue that CAL provides greater access, enhances quality and overcomes the inherent disadvantages of distance learning. Yet the apparent eagerness to develop innovative CAL applications is not evidenced in an educational survey of built environment postgraduate course provision. On the contrary, only small pockets of CAL activity are available.

A new distance learning project management educational software application ($DIME^{PM}$) is developed and compared with a traditional multiple media resource and a well-established postgraduate module delivered in part-time mode. The design of $DIME^{PM}$ draws on the expertise of experienced practitioners in HE and the views of leading academics in the field. Qualitative and quantitative approaches are employed in a longitudinal evaluation that assesses the relative learning gains, student attitude and confidence of HE students. And, in order to gain reaction from industry, $DIME^{PM}$ is subjected to an illuminative evaluation within a leading engineering and project management consultancy.

The research study finds no significant difference in the academic performance of students in the control and experimental groups. However, it is clear that technically orientated tasks lend themselves more readily to CAL than interpersonal skills. Distributed educational packages provide opportunities for enhancing distance learning but alternative pedagogic approaches are needed to encourage web-based dialogue and promote vicarious learning. Practitioners suggest that the distinction between these alternative delivery methods is artificial and that an integrated approach should be explored. Crucially, the research identifies considerable advantage in linking outcomes to delivery mechanisms and advocates the use of an "Associated Delivery" model.

PREFACE

The development of the distributed interactive multimedia project management educational resource (DIME^{PM}), upon which the HEI and industry evaluations are based, relied on the contributions of many colleagues within Leeds Metropolitan University (LMU) and specialist input from "guest lecturers".

Learning Technology Services (LTS), a department within the university's Learning and Information Services (LIS), was responsible for the production of all audio and video components within DIME^{PM} and the multiple media learning resource.

The Capability Learning Support Unit (CLSU), funded by the Faculty of Health and Environment, provided specialist design services and, under the direction of the researcher, designed and authored the multimedia package. The researcher's role is perhaps best described as that of a "hands-on" project manager, responsible for the planning, control and implementation of DIME^{PM} together with the co-ordination of the technical and academic input necessary for the creation of the learning resource. Both the researcher and the CLSU scripted the interactive exercises within DIME^{PM} (acknowledged in Chapter 7) while the former created the "Blackboard" virtual learning environment and undertook the hybrid evaluation of each delivery mode.

Academic leadership of Project Management (Level M) was jointly shared by the researcher and Gerard Wood. However, "guest lecturers" who contributed to the School's Guest Lecture Programme and assisted in the delivery of the module wrote Topics within the project management resource.

The winners of the Chancellor's Award for Innovation in Teaching and Learning (September 2000) were:

Robert Ellis
Gerard Wood
Adrian Riley
Ian Dickinson

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Chapter 1

Introduction

1.1 Introduction

Today's skills will not make tomorrow's profit

(CITB, 2000)

The Construction Industry Training Board (CITB) report "*Managing Profitable Construction*" states that construction companies with higher skills "make more money, complete more projects on time and have more satisfied clients". It is a view widely accepted by leading construction industry bodies such as the Construction Industry Board (CIB), Construction Industry Council (CIC) and the Movement for Innovation (M^4I), by government supported initiatives such as the University for Industry (UfI) and the Investors in People standard (IiP), and by Higher Education Institutions (HEIs).

The growth in postgraduate education in the construction sector during the 1990s supports this contention. There is increased interest in lifelong learning and a general acceptance of the need to update skills, either through in-company training and development programmes, continuous professional development (CPD) activity or further study leading towards some form of academic award. HEIs have responded to these demands by offering new "modular" postgraduate courses that embrace many of the radical changes occurring in the construction industry and accommodate the needs of the busy professional by virtue of their flexible delivery modes.

Just as John Egan's (1998) report "*Rethinking Construction*" provided a catalyst for far reaching change and the pursuit of continuous improvement within the construction industry, so too did Laurillard's (1993) seminal work "*Rethinking University Teaching*" and the highly influential Dearing Report (1997) "*Higher Education in the Learning Society*", stimulate reflection on the learning process and awaken interest in the role of new technology in educational development strategies. Academics and educational technologists (Benyon *et al,* 1997; Whalley, 1998; Grantham and Hunt, 1999; Knight and Watson, 1999) suggest that computer-aided learning (CAL), might have important pedagogic benefits for the learner. Unlike traditional resource based learning, where media is "chunked into larger components", novel multimedia applications provide opportunities for tighter integration and increased interactivity (Benyon *et al*, 1997).

The motivation for the study is as a direct consequence of the perceived growth in built environment postgraduate education, the new and exciting opportunities afforded by CAL and curiosity. Could CAL provide a better learning experience than other, well established, delivery techniques? What factors influence the effectiveness of CAL? How might CAL be integrated into existing educational programmes? Will CAL change the role of the learner (and the tutor)? This chapter provides a contextual overview of the drivers of change in built environment education and outlines the research problem and methodology upon which this study is founded.

1.2 Project management education in the UK construction industry

The needs of construction industry clients have become increasingly complex, in response to a diverse range of environmental, social, organisational, market and economic factors (Walker, 1996; Smith and Love, 2001). However, many authorities argue that the industry has been unable to meet the challenges created by these conditions (Turner, 1990; Andrews and Derbyshire, 1993; Latham, 1994; Egan, 1998). So-called "fragmentation" (Kagioglou *et al*, 2000) within the development process often lies at the heart of such criticism.

The traditional separation of the design and construction phases, accentuated by increased specialisation, technological advances and off-site manufacturing processes, Kagioglou *et al* believe, provides scope for confusion of responsibility and highlights deficiencies in the management of construction projects. Construction has always been characterised by the "one-off" nature of the business. Projects are unique and regularly draw together a bespoke combination of organisations whose purpose it is, is to complete the work on time, within cost and to the required quality. Undoubtedly the constant reformation of the project team has impacted upon the efficiency of the industry, although Kululanga *et al* (1997) queries whether this observation can be fully justified when one compares the rate of improvement of other "one-off" businesses such as in the shipbuilding and aerospace industries. The company of the future, Kululanga *et al* (1997) speculate, will comprise a "professional core" of managers performing critical activities, a "contractual fringe" doing work that can be undertaken more cheaply by external agencies and a flexible "basic workforce".

Egan (1998) calls for a radical change in the way "we" build and advocates the integration of the entire design and construction process. The Egan Report contends that the construction industry can become more efficient, delivering enhanced quality and value for money, through the use of new, less adversarial contractual procedures and the application of best practice in management and manufacturing. Consequently project managers, like many specialists in the design team, have been forced to review their traditional roles and responsibilities and align their services to the needs of the client. Kagioglou *et al* (2000) observes that project management has traditionally focused on the actual construction phase of the project with pre- and post-construction activities being neglected. In considering the whole life of a project the project manager must necessarily address projects from a business and technical perspective. This view is shared by the CITB (2000) who state that the new demands created by partnering and strategic alliances require companies to review the skills of their senior and business development managers.

To effect such change in a contemporary construction industry there is need for a review of project management education. Indeed the earlier work of Schön (1991) indicates that a review of management education is necessary. A perceived crisis in confidence of the professional is evidenced by leading practitioners who speak of "a new awareness of a complexity which resists the skills and techniques of traditional expertise" (Schön , 1991). Adham (1992) develops a "portfolio of project management skills", having conducted a survey of the educational backgrounds of project managers, and concludes that many practitioners possess shallow managerial, financial and legal knowledge. Stokes (1997) agrees that project management covers a wide range of skills and stresses the need to provide balanced provision that meets the needs of the project manager. Whereas the general manager deals with one or more processes such as forecasting, planning, co-ordinating, communicating and controlling, the project manager is involved in all such processes from inception to completion (Waterhouse, 1998). The Association for Project Management (2000) reinforce the need for a broad range of knowledge in their Body of Knowledge (4th edition), listing seventy-five attributes, which focus on competencies and individual needs for the management of projects.

Andrews and Derbyshire (1993) in their report "*Crossing Boundaries*" advocate greater commonality in education, training and continuing professional development of construction professions. The industry, they suggest, should respond to this challenge in a flexible creative way. Fryer (1997) also stresses the need for innovative education that might "encourage people to learn, so that they realise their potential and make the organisation better at doing what it does". Learning is not an occasional or one-off activity for employees. In a changing world, where knowledge quickly becomes obsolete, the best way to help individuals, he believes, is to encourage employees to become self-directing, lifelong learners. In order to facilitate a move away from traditional provision towards action-centred and work-based learning, postgraduate education, training and CPD need to offer a variety of "learning interactions" (Fryer, 1997) that actively involve people and avoid passive learning environments. Gunn (1997) believes that academic education and work place competence are complementary. People are recruited on the basis of their qualifications and their experience.

We strive to ensure that they both 'know' and 'can do'.

Gunn, 1997

What then should the project manager know? And, how might this knowledge be gained?

Project management education tends to be broadly divided into two categories (Dunton, 1997). Namely, planning and control, involving techniques such as critical path analysis, programme evaluation review technique (PERT), risk management and value management (collectively known as "hard" skills) and interpersonal or people management (sometimes referred to as "soft" skills). Dunton (1997) believes that the former had generally been targeted in educational programmes through "technical" modules and suggests that personal skills should be introduced into the curriculum. However, construction activity is widely distributed across all the geographical regions of the UK (Fryer, 1997) and project managers must remain mobile if they are to discharge their duties, as professional teams move regions in pursuit of contracts (Briscoe and Wilson 1993). It is contended that project management educational provision must also be sufficiently flexible to meet these needs. Just as construction sites are remote from head offices and therefore well suited to reap the benefits of IT and recently introduced communication technologies, so too must educational providers make use of improved communication within the education process.

1.3 Communication and information technology in Higher Education

The university sector has experienced a period of unprecedented change (Richardson 1996; Dearing, 1997; Barrett, 1998). Changes in the funding of students following the establishment of the Higher Education Funding Councils, the expansion of the education system (Davies, 1998) and the decline in levels of funding for universities (Frank, 1996; Richardson, 1996) are forcing many colleges to rethink their teaching and learning strategies. Davies (1998) questions how the sector will cope with a student population that has increased by almost two thirds in the last decade without significant reforms in course content, qualifications, research funding, staffing, continuing education and educational delivery.

Postgraduate student numbers have also increased, doubling in the period between 1989/90 and 1995/96 (CVCP, 1996), and with increased emphasis being placed on lifelong learning by HEIs and professional institutions alike, further growth is expected in part-time and flexible study.

Musselbrook *et al* (2000) believe that the current pace of technological change and the fact that fewer jobs are for life, provide the key drivers for lifelong learning.

> *The "graduate job" is disappearing and nearly all worthwhile jobs will soon demand high level skills and qualifications.*
>
> Davies (1998)

Students are demanding a more flexible approach to learning. They are part-time, mature and physically remote. Yet there is some difficulty in determining the number of distance learning as opposed to part-time students in the UK (McCartan, 2000). McCartan suggests that there has been a marked expansion in distance learning and estimates that there are approximately 6000 students undertaking this mode of study, the major provider being the Open University (OU).

The report of the National Committee of Inquiry into Higher Education, "*Higher Education in the Learning Society*" (Dearing, 1997), offers a vision of HE over the next 20 years. In promoting applied learning through the removal of traditional boundaries between vocational and academic education, the Dearing Report reinforces the need to create a society committed to learning throughout life. Dearing (1997) states that government funding requires reductions in unit costs - reductions that take place against a background of a unit cost reduction of more than 40 per cent over the last 20 years. Substantial redundancies are forecast and short-term pressures to reduce costs are perceived as damaging to the intrinsic quality of the learning experience.

Innovative delivery methods, therefore, are required to cope with increased demand and the changing profile and study pattern of students. Moreover, new technologies are acknowledged as providing one means of being able to respond to these demands, improving the quality, flexibility and management of HE (Davies, 1998).

Dearing (1997) recognises this imperative, stating that IT will not only impact upon the skills that HE need to develop in students but that it will also affect the way in which these skills are delivered. Flexibility, Porrit (1997) suggests, together with communications and information technology (CIT) will play a vital role in supporting future development.

The Government's response to the Dearing Report (1997) entitled "*Higher Education for the 21st Century*" (DfEE, 1998), emphasises the key role that HE has in "exploiting new technology and flexible delivery so as to make itself more accessible and ensuring that maximum use is made of its facilities through longer opening hours". Moreover, the response highlights the importance of the Institute of Learning and Teaching (ILT) in Higher Education. The establishment of the ILT together with the National Teaching Fellowship Scheme and the formation of the Quality Assurance Agency are jointly perceived as being important drivers for the development of technology based learning and its evaluation (Martin and Beetham, 1998).

The Government also published a complementary Green Paper "*The Learning Age*" (DfEE, 1998), subsequently taken forward in the White Paper "*Learning to Succeed*" (DfEE, 1999), which proposed an entirely new type of institution - the University for Industry (UfI) - to facilitate links between "business and individuals to cost-effective, accessible and flexible education and training". The UfI, the government believes, is one of the best ways to overcome the barriers to learning and, via new broadcasting and other technologies, will create a framework of opportunities for people to pursue lifelong learning.

> *Learning throughout life will build human capital by encouraging the acquisition of knowledge and skills and emphasising creativity and imagination.*
>
> (Blunkett, 1998)

The Higher Education Funding Council's (HEFCE) e-University project also aims to establish innovative and dynamic new methods of delivering high quality higher education to students via the Internet (HEFCE, 2000). Its main target markets are:

- UK postgraduates and those seeking continuing professional development;
- "corporate universities and businesses; and
- selected overseas markets - individuals, companies and governments.

As such the e-University project is seeking to harness much of the "under-capitalised" and "small-scale" e-Learning activity being developed in UK universities (HEFCE, 2000). However government funding had previously been made available for the development of CAL. In February 1992 the Universities Funding Council (UFC) launched the first phase of the Teaching and Learning Technology Programme (TLTP) which aimed to make teaching and learning more productive and efficient by harnessing modern technology. Approximately £7.5 million was allocated to 43 projects and in April 1993 the four successor funding bodies, HEFCE, the Scottish Higher Education Funding Council (SHEFC), the Higher Education Funding Council for Wales (HEFCW) and the Department of Education for Northern Ireland (DENI) committed a further £3.75 million over a three year period seeking to build on the work in the first phase (TLTP, 1996). The third phase of the TLTP, which commenced in March 1998 considered both the implementation and evaluation of computer-aided learning throughout curricula between collaborating institutions. Thirty two projects were funded totalling approximately £10.5 million over three years (TLTP, 1999). In parallel with the TLTP initiative the Fund for the Development of Teaching (FDTL) was also launched by HEFCE and DENI in December 1995. These projects sought primarily to encourage the dissemination of good practice in Higher Education and produce resources for teachers and developers. Common to many of the projects were the themes of peer assessment, transferable skills, student group work and lifelong learning (FDTL, 2000).

The approach taken during the early stages of the TLTP programme was severely criticised by authorities such as Laurillard (1993), who suggested that funding had been allocated to projects that developed materials for a particular medium and then proceeded to provide "post hoc" rationalisations for what had been done. While this particular concern was seemingly addressed in later projects, the Funding Councils themselves also expressed concern that the plethora of initiatives had become "particularly messy" (HEFCE, 1998).

HEFCE recommended a rationalisation of existing programmes and, in an attempt to provide a "one-stop shop" for computer-related educational information, commissioned an on-line database (CITADEL) which catalogued the range of CIT materials for learning and teaching in the UK. Baume and Baume (2000) report that in 1999-2000, £26 million of HEFCE's annual budget (£4.22 bn) was devoted to special initiatives through the Teaching Quality and Enhancement. In addition to the continued support for TLTP and FDTL Phase 3 projects (now managed by the National Co-ordination Team (NCT) on behalf of HEFCE and DENI), the Learning and Teaching Support Network (LTSN) and the National Teaching Fellowship Scheme were launched. Indeed lifelong learning seems likely to assume an even higher profile, as evidenced by recent news of a further £10.5 million HEFCE funded initiative administered through the ESRC for a third phase of the Teaching, Learning Research Programme (TLRP) (Shaw, 2001).

1.4 The learning process and the role of educational technology

McNaught and Kennedy (2000) ask the question "What is the business of a university in the new millennium?" They conclude that universities need to provide staff with the physical and intellectual space to pursue research and provide teaching for growing student numbers in order to guarantee funding. Their solution is, in part, to adopt flexible modes of delivery. Flexible learning must allow for variations in study time and may rely on the use of technology to enhance access to learning. However, they caution, that this must not be at the expense of a sound pedagogic methodology.

> *Good educational design is the key to successful learning.*
>
> (McNaught and Kennedy, 2000)

One of the most popular descriptions of the learning process is drawn from Kolb's (1984) model of experiential learning. Kolb describes a cyclical model of the learning process based upon experience, reflection, conceptualisation and experimentation (refer to Figure 1.1). As such it displays similarities with other learning cycles, (Mumford, 1984; Kirk, 1987) in that the organisation of a learning experience is the key element in the process, and is in sharp contrast to the orthodox didactic approach where "the teacher teaches and the student learns" (Dennison and Kirk, 1990).

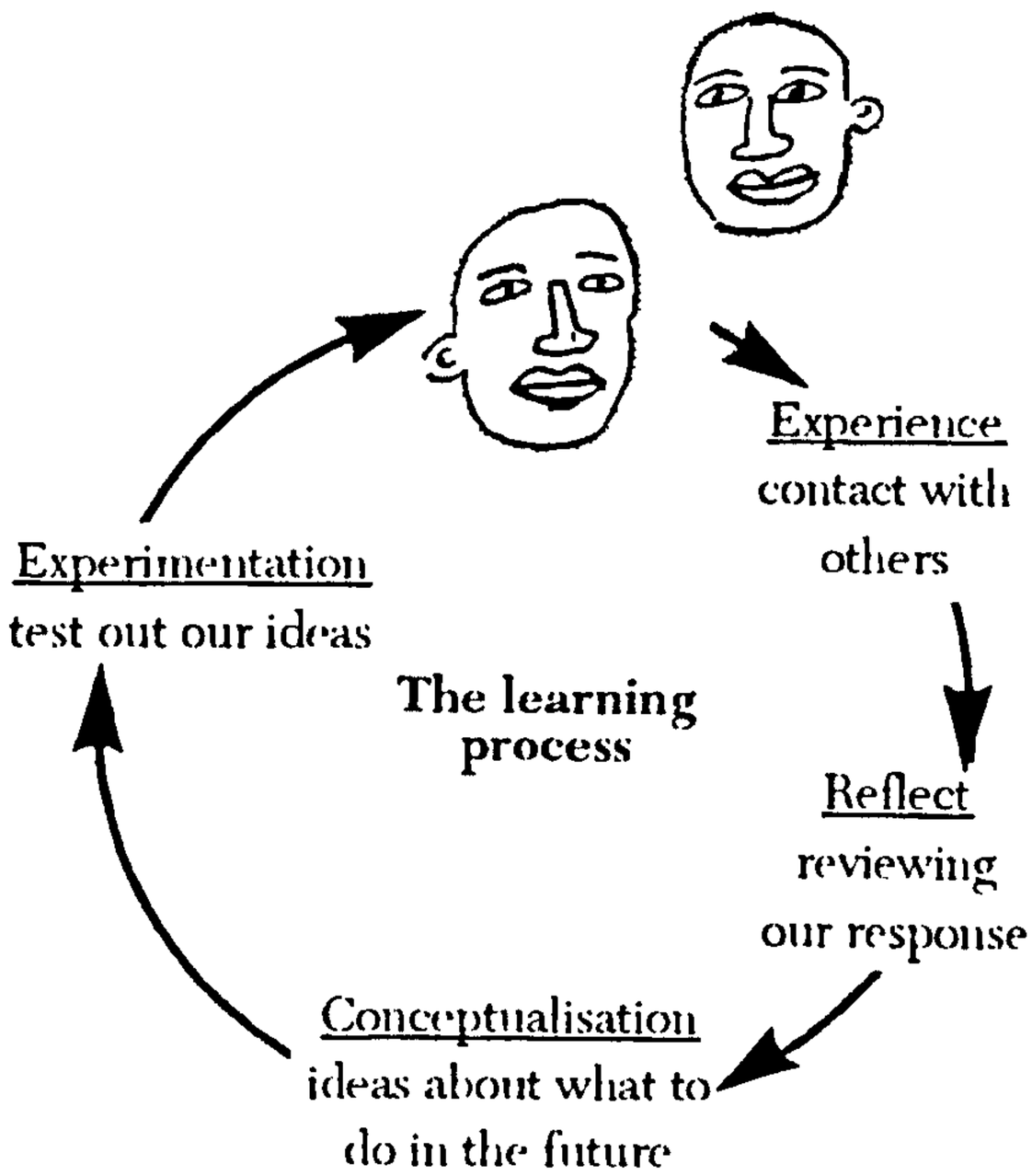


Figure 1.1 Kolb's Learning Cycle (adapted by Evenden and Anderson, 1992)

Mumford (1995) argues that all kinds of learning are embraced by these learning cycles but that many activities fail because they concentrate overly on one stage in the process. Citing business games and out-door training as examples of learning based upon experience, he suggests that such activities sometimes concentrate too much on excitement at the expense of reflection and planning. Conversely, lectures or books are concerned with the delivery of information rather than the practical application of the information provided. A balance across all four stages in the learning process is advocated.

Smith (1983) recognises the importance of experience in adult education and suggests that mature students learn best when six conditions of learning are met: learners must want to learn; be able to utilise their experience; relate what is learned to their developmental needs; ensure that the amount of autonomy exercised is congruent with the method of delivery; be comfortable with the learning environment; and be able to study in accordance with their preferred method.

McDowell (1983) disputes this, observing that the educational needs of part-time students are quite different to those of full-time students. Part-time students, he contends, are immersed in the world of work. They have different motivations for pursuing academic studies and less time available to complete modules and assessment. Distance learning, McDowell (1983) concludes, addresses the key requirement for part-time students, namely avoiding mandatory attendance at college.

The concept of an individual's preferred method or learning style also lies at the heart of Kolb's (1985) Learning Style Inventory (LSI). Unlike a didactic mode of delivery where learning style has less significance, experiential learning is predicated upon the notion that students construct their own learning cycle (Dennison and Kirk, 1990). Although Honey and Mumford's (1986) Learning Style Questionnaire is preferred by many authorities (Sheehan and Kearns, 1995; Dixon and Woolhouse, 1996; Sadler-Smith, 1997) there is general agreement that a mismatch between the teaching style and learning style of the student is detrimental.

Laurillard (1993) believes that it is important for teachers to know how their students think. "Without this one builds on sand" (Laurillard, 1993). In a critique of academic learning she reaffirms the belief that concepts need to be grounded in experience and practice before they can be abstracted. The learning process, Laurillard states, must be a dialogue between teacher and student, where the teacher is present to guide, advise, comment on progress and offer explanations. So-called "guided discovery".

In summary, Laurillard contends that all that can be definitely claimed is that there are different ways of conceptualising the topics that are taught. The only prescriptive implications are that:

- there must be a continuing dialogue between teacher and student;
- the dialogue must reveal both participants' conceptions;
- the teacher must analyse the relationship between the students and the target conception to determine the focus for the continuation of the dialogue; and
- the dialogue must address all aspects of the learning process.

Many educational theorists hold the view that discovery learning stimulates higher order thinking (Schank, 1993). However, Laurillard (1995) suggests that discovery learning, even at postgraduate level, may be over-ambitious. Clearly tension exists between traditional approaches that adopt a "hand-holding" study guide format and innovative delivery that enables interactive freedom. The challenge faced by HEIs is to ensure that innovative new approaches to teaching and learning allow this crucial aspect of the learning process to take place.

MacFarlane (1994) believes that the major challenge for academics is to develop supportive environments that offer self-paced, tutor-supported learning in a flexible way and in a variety of locations. He suggests that technology provides an opportunity for releasing tutors from the lecture theatre in order to be able to give greater individual tutorial "support" - a belief which is echoed by the CVCP (1996), albeit in the context of undergraduate provision. The CVCP also acknowledges that computers should not be regarded as a panacea and that the need for face-to-face interaction in HE is essential.

Kirkwood (1996) argues that educationally effective multimedia must do much more than supply present information. It should enable learners to interrogate, evaluate and reflect upon, not only the information provided, but also their existing relevant knowledge and experience. Slaven *et al* (1996) investigates the potential benefits of information technology as a medium for transmitting safety-related information and concludes that the principal benefits are:

- Flexibility of training site;
- Consistent delivery of training content;
- Easily auditable training outcomes;
- Greater retention of information learned;
- Self-paced training delivery mechanism; and
- Increased trainee interest.

The growing importance and value of multimedia electronic information available over the network is recognised by Dearing (1997). Recommendation No. 46 states that by 2000/01 HEIs should ensure that all students have open access to a networked desktop computer and the expectation is that by 2005/6 all students will be required to have access to their own portable computer. "Multimedia" is variously defined, but Barker and Tucker (1990) offer a typical definition:

> *A collation of disparate media emanating from a single presentation device, typically a computer*

The criteria upon which decisions should be made regarding the use of multimedia and distance learning are grouped under the following categories: access; cost; teaching and learning; interactivity; organisational issues; novelty; and speed i.e. ACTIONS (Bates, 1995). Tucker (1997) puts forward a more simplistic view. Some benefits, he states, may be classified as being of direct relevance to the organisations. Others are beneficial to the learner. While these two categories overlap, it is acknowledged that the latter is often less easy to quantify. Learning is related to the quality and quantity of thinking undertaken by learners as they interact with computers while learning outcomes are a function of the learning process which is activated by instructional techniques and other learning activities (Henderson *et al*, 1998). The extent to which computers promote thinking skills and strategies, Henderson *et al* contend, is largely unknown.

One means of enhancing the learning experience is to provide conferencing facilities on the Internet. Twining (1999) argues that new technologies such as synchronous i.e. real-time, conferencing and asynchronous communication do not merely provide a mechanism for delivery, they also offer the opportunity to enhance students' learning. Musselbrook *et al* (2000) reports that conferencing technologies are being used in HE partly to encourage dialogue between tutors and students and partly in response to increased demand for more flexible learning in the context of lifelong learning.

For example, the University of Sunderland provides academic video conferencing for undergraduate and postgraduate students, allowing them to converse with commercial and academic organisations (Hatley, 1997). Queen Margaret College and Heriot-Watt University use alternative video link technology to allow the remote delivery of specialist material without the need for students to travel between campus sites (Brown, 1999). Such projects are regarded as being successful and despite "intimidating" equipment and tutors experiencing "feelings of isolation", Brown reports on plans to introduce video conferencing links on postgraduate courses with many other universities. However, there are technical problems associated with this form of technology. Miah *et al* (1997) state that Internet-based video conferencing places a heavy demand on servers that, although adequate for file transfers, electronic mail and news groups, are unable to cope with the demands of video transfer. These difficulties are further compounded by the "complexity of multiple formats, emerging standards and rapid changes in the player software and compression techniques" (Miah *et al*, 1997).

The Internet is also being used in teaching, research and administration. It has become an increasingly important tool for external (Internet) and internal (Intranet) publishing and despite such uncertain issues as security, copyright and editorial control, web-based delivery has found serious application in academia (Kelly, 1995). But the ease and speed of implementation, often associated with web-based courses, can result in "design by imitation" and lead to a "real lack of innovation" (Fowler and Mayes, 1999). The web is slow (Benyon *et al*, 1997). Problems associated with processing speed and storage capacity are further exacerbated when multimedia packages are delivered over the Internet or local area network. Hence, web-hybrid CD-ROMs are commonly used to overcome these limitations, combining media-rich content on CD-ROM with the immediacy and resources of the Internet (Macromedia, 1998). A clear rationale for any proposals to use networks for educational delivery, therefore, is essential (Kirkwood, 1996). Paolucci (1998) supports Laurillard's assertion, that hypermedia software does not necessarily lead to improved performance. In order to make best use of the information available on the Internet, learners need to develop retrieval, selection and evaluation skills.

Furthermore, the combination of high-level learner control and a rich learning environment, Paolucci (1998) argues, can lead to "hyperchaos". Careful attention to instructional design and multimedia development is needed (Wild and Quinn, 1998).

1.5 Research Methodology

1.5.1 Problem Definition

The development of resource based teaching and learning materials (Ellis and Riley, 1997a&b) and discussions at a CTI/LTDI workshop at Glasgow (Caladonian) University in April 1997, provided the catalyst for investigating whether or not distributed interactive multimedia could provide high quality postgraduate learning in the construction industry. The vague idea of a potential research problem was refined by an initial review of literature using a keyword search of on-line databases i.e. BIDS ISI, Emerald (MCB), IDEAL (Academic Press) and Masterfile (EBSCO). However, a range of educational, economic, strategic and pragmatic factors influenced the selection of project management as the focus for this research study.

In a review of management development, Fryer (1997) argues that British managers lack the education and development opportunities of their competitors. He contends that the great majority of UK senior and middle managers have no formal management education or training. The discipline of project management, therefore, appears to offer considerable educational opportunities for experienced staff, both within and outside the construction industry.

Wood *et al* (1998) suggest that universities have a key role to play in delivering CPD, postgraduate education and distance learning. The use of electronic media facilitates distance learning and just-in-time education which, they conclude, might be of considerable benefit to the construction industry. Consistent with many government, HE and construction related reports, it is the Dearing Report which articulates most clearly the educational rationale upon which the dissertation is based:

> *New technology is changing the way information is stored and transmitted. This has implications for both the skills which higher education needs to develop and the ways in which it is delivered. (Dearing, 1997)*

Pedagogic issues associated with interactive and distributed multimedia media are a concern for many authors. For example, Maule (1997) identifies criteria such as active learning, peer and partnership learning, applied and integrated subject learning and dynamic real world learning as being critically important when designing technology supported or delivered education.

> *Although it is now not unusual for learning technology to be seen as a core component of many courses, there continues to be a need for research about whether technology makes an effective and positive contribution to the learning experience for students (Mogey, 1998a).*

Tergan (1998) concludes that existing theories and conceptions on the effectiveness of multimedia for enhancing learning have often been misleading and require further empirical validation. The extent to which distributed environments facilitate higher order cognitive processes is also unknown (Henderson *et al*, 1998).

The developmental costs associated with CAL are also in doubt. For example, Crabb (1990) states that the provision of one 'student hour' of material takes 10 hours for audio, 50 - 100 hours for written and over 300 hours for video material. Oakes (1997) is more pessimistic, quoting figures of between 40 hours and 1200 hours development time per hour of CAL instruction while Athanasou (1998) provides a global estimate of 600 hours to prepare an interactive CD-ROM package. Moreover, there may be additional capital cost attached to the provision of workstations, replacement hardware and networking infrastructure together with the cost of updating courseware (Wild, 1994). Educational software development must therefore have a broad application (Neilson and Thomas, 1996), thereby reducing overall cost margins and increasing the return to producers, and stimulate a stronger market for complementary products (Oliveira, 1990).

The decision to evaluate postgraduate education in project management was also influenced by the School of the Built Environment's learning, teaching and assessment strategy. Project management had previously been delivered at undergraduate level and plans were in place to expand the provision at "M" level, shifting the mode of delivery from a part-time to a distance learning format. Opportunities to deliver in-company training courses for several engineering and cost consultancies, together with a perceived growth in project management inter-faculty "servicing", provided further reasons why flexible postgraduate provision might be attractive to the School. At the beginning of the research study only one postgraduate project management related module existed within the School's postgraduate academic portfolio. The module, named simply "Project Management" (module reference EQ11.1), was selected for multimedia delivery on the basis that:

- It was a well-established module, which had been subject to the School's quality control procedures over a five-year period;
- The module content was sufficiently generic to be offered to a broad range of students within the School's postgraduate modular scheme e.g. MSc Facilities Management, and MSc Construction Law and Arbitration;
- The introductory nature of the module sat well within the proposed curriculum for a MSc Project Management course; and
- Interest had been expressed in offering Project Management as an elective i.e. an optional module, on the MBA programme for the Leeds Business School.

EQ11.1 is a 12 credit M level module, equivalent to 150 hours of study.

1.5.2 Aims and objectives

Edwards *et al* (1995) recommend that it is important for a researcher to limit the focus of evaluation to "one or two" areas, when dealing with CAL materials, in order to make the process manageable. They identify four headings or "aspects" which have been used successfully by a number of researchers, namely content, layout, usability and pedagogy. It is this latter aspect, the concept of pedagogic effectiveness, which is central to this research study.

The aim of the research is:

> ***to determine the pedagogic effectiveness of distributed interactive multimedia in the delivery of postgraduate project management education and training.***

The Tavistock Institute (1998) state that pedagogic effectiveness is determined by two principal components:

- pedagogic effectiveness i.e. do learners learn and how effectively do they learn?
- pedagogic responsiveness i.e. are user needs met and how quickly are they met?

The Institute contend that both requirements are not only closely inter-related but interdependent. Pedagogic effectiveness, they continue, is usually assessed in two phases: acquisition of information, knowledge and skills; and using and applying information, knowledge and skills acquired to specific contexts.

Six objectives were subsequently developed from the research aim:

- to review existing provision of postgraduate built environment education and identify the key factors that influence the development of distance learning delivery;
- to select an appropriate pedagogic framework for the development of computer-aided learning programs;
- to design, create and implement a distributed interactive multimedia educational project management program at postgraduate level;
- to conduct a comparative longitudinal evaluation of student attitude, performance and confidence arising from part-time, multiple media and distributed interactive multimedia modes of study;
- to determine the issues that affect the quality of the learning experience in a HE and an industry context ; and
- to develop a learning strategy that maximises the potential of distributed interactive multimedia.

1.5.3 Evaluation methodology

The research hypothesis to be addressed in this thesis is:

> ***Distributed interactive multimedia is more effective than part-time or multiple-media distance learning in the delivery of postgraduate project management education and training?***

Macleod (1998) states that "every educational intervention is an experiment in some sense of the word; you can change something about the students' experience, predicting that better learning will take place". As such, the independent variable, also referred to as the experimental or treatment variable (Fraenkel and Wallen, 1996), is the delivery mode used to promote learning. The dependent variable in this study is pedagogic effectiveness.

Evaluation of courseware, Draper (1997) argues, should also be based on the performance and feedback of real students as part of a real course. Experiments comparing alternative ways of teaching are deemed to be more convincing than experiments based solely on the effectiveness of CAL software (Draper, 1997; Clow, 1999). Without comparison it is impossible to make any statement about value because programme evaluation is largely a relative process (Athanasou, 1998). Accordingly the pedagogic effectiveness of CAL in the delivery of a postgraduate project management module is determined by comparing the following delivery methods (refer to Figure 1.2): part-time (PT) and distance learning, using multiple-media (MM) and a distributed interactive multimedia education package (DIME^{PM}).

A summary of each delivery mode subject to this evaluation is outlined in Table 1.1, using the "learning system component classification" adopted by Paquette (1998).

(a) Part-time (b) Multiple-media (c) Distributed interactive multimedia

Figure 1.2 Project Management learning resources

The first implementation is traditional part-time module delivery. It is characterised by seven, three hour, taught sessions, which rely heavily on classroom based, hands-on activities e.g. formal debates, design exercises and management games, and specialist input from "guest lecturers". The Navigation-management space comprises printed guides that contain essential reading and student-centred activities, and video. Communication and collaboration space relies on scheduled discussion in contact sessions and informal support in face-to-face or telephone tutoring.

The second implementation is a multiple-media distance learning module. The Navigation-management space here uses printed guides, "readers", video and independent software applications. Communication and collaboration space comprises introductory workshops, email and telephone tutoring.

The third implementation relies primarily on technology-based media. Authorware Attain software is used to create an interactive multimedia package. The CD-ROM incorporates hyperlinks and scripted interactive activities to a virtual learning environment (VLE) and on-line learning resources. The VLE incorporates synchronous and asynchronous communication facilities, together with downloads i.e. text files and on-line quizzes.

Components of Leaning System	Part-time Delivery	Distance Learning Multiple-media	Distance Learning DIME^{PM}
Knowledge models	Introduction to project management	Introduction to project management	Introduction to project management
Learning scenario	Text-based study guide, videos, visiting guest lecturers	Text-based study guides, videos, audio tapes	Integrated media on CD-ROM including problem solving and case studies
Navigation management space	Printed guide and cross-reference to texts	Printed guide and cross reference to "readers" and texts	Bespoke controls developed in Authorware providing access to content, assessment and on-line data
Information space	Two 30 minute videos	Two 30 minute videos, two audio tapes and screen movies of software applications	On-line resources e.g. Blackboard, e-journals, and CD-ROM
Production space	Not applicable	Not applicable	Authorware designed interactive exercises and Digital Notepad
Communication and collaboration space	Face-to-face tutoring, telephone tutoring	Introductory workshop, email and telephone tutoring	E-mail, computer conferencing (e.g. discussion threads), telephone, and email.
Assistance space	As above	As above plus programmed study guide	As above plus CD-ROM help facilities i.e. FAQs, "About" guide and exercise feedback.

Table 1.1 Three implementations of the Project Management module

However, many academics (Gunn, 1997a; Draper, 1997; Oliver, 1997) recognise the drawbacks associated with the use of experimental methods in determining the effectiveness of educational software (or courseware). Typically, Gunn (1997a) suggests, CAL should not be evaluated in isolation. Rather, "it must examine the effects of particular resource combinations within specific learning environments".

A combination of quantitative and qualitative methodologies are advocated so as to reinforce confidence in research findings. Accordingly the evaluation design is of a "hybrid" nature and is influenced by the systems approach advocated by Kirkpatrick (1967) and Morris (1984), together with the naturalistic methods adopted by Scriven (1972). A detailed account of the integrative and illuminative approaches used in this study, are outlined in Chapters 8 and 10 respectively.

This study, therefore, seeks to build on the work of Shinkins (1995) and Passerini (2000), who undertook similar evaluation research. However, the integration of Internet capabilities within educational software and the use of multiple media distance learning resources distinguish the work from that of Passerini (2000) and enables a critical analysis to be undertaken of the added value offered by web-hybrid multimedia resources.

1.5.4 Structure

The development of innovative, highly flexible educational programmes embraces a number of inter-related activities. Benyon *et al's* (1997) process of developing multimedia identifies a series of key stages, which provide the structure for this dissertation: courseware specification; instructional design; multimedia development; integration; implementation; and evaluation (refer to Figure 1.3).

Courseware specification: The aims and objectives of the project management educational course are discussed in the context of: the changing role of the project manager in a construction industry keen to achieve new levels of performance; government policy aimed at raising educational standards, improving skills acquisition and engendering; and a new culture in HE, as it seeks to satisfy the twin demands for greater efficiency and enhanced quality of academic provision [Chapters 1 & 2].

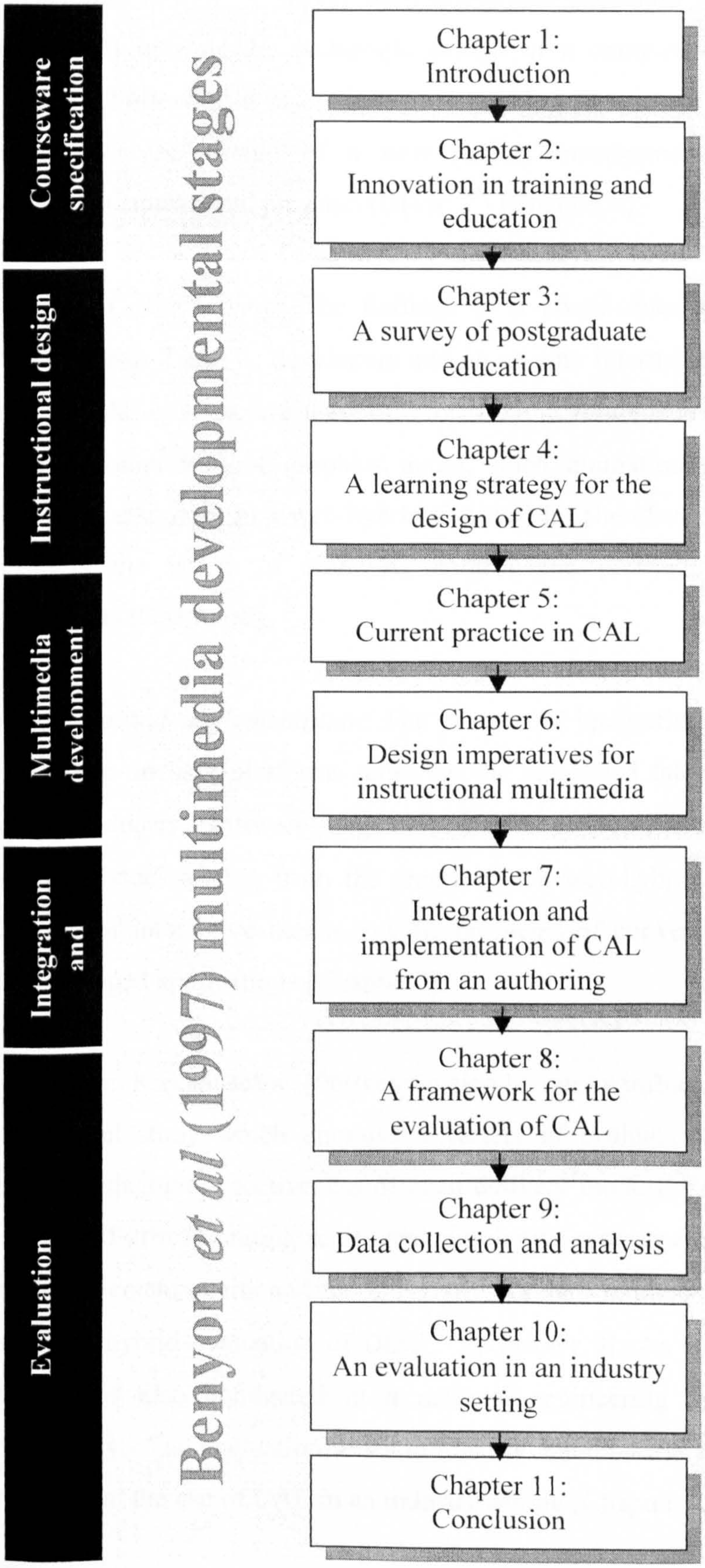


Figure 1.3 Thesis structure

Instructional design: A survey of postgraduate education in the built environment [Chapter 3] informs the pedagogic design of a computer-aided distance learning resource. Following a brief reprise of learning theories, a learning strategy is put forward for the design of a new project management distributed interactive multimedia educational program ($DIME^{PM}$) [Chapter 4].

Multimedia development: The findings of a postal questionnaire, administered to TLTP (Phases 2 and 3) developers and an on-line international survey of academics running CAL courses, are used to inform the development of $DIME^{PM}$ [Chapter 5]. $DIME^{PM}$ comprises text, graphics, audio, video, animation, interactive exercises and web-based resources in a web-hybrid CD-ROM. Therefore, the developmental stage considers the issues of structure, control and presentation of the multimedia components [Chapter 6].

Integration and implementation: The process of integrating media and instantiating courseware on user platforms relies on the combined talents of graphic designers, video producers, software engineers and courseware authors. Accordingly, the technical issues arising from the creation of a web-hybrid CD-ROM focus on the scripting of interactive media and the problems of converting authored pieces into web-packaged applications [Chapter 7].

Evaluation: Kirkpatrick's (1960) evaluation hierarchy influences the development of a longitudinal study which employs a variety of evaluation tools to determine the relative pedagogic effectiveness of each delivery mode [Chapter 8]. Pre- and post-testing, self-efficacy rating scales and summative assessment, combined with Interest and Involvement charts and the university standard module evaluation pro-forma are used in a hybrid evaluation of $DIME^{PM}$ [Chapter 9]. An illuminative evaluation of $DIME^{PM}$ is also conducted in a national engineering and project management consultancy. The evaluation seeks to identify "facilitators" and "barriers" to learning arising from the use of CAL in an industry setting [Chapter 10].

The findings of the research inform the development of a learning strategy that seeks to maximise the potential of e-learning in HE and in-company training. Recommendations are offered regarding the future development of e-learning [Chapter 11].

Chapter 2

The need for innovation in training and education to support a new paradigm in project management

2.1 Introduction

Construction is a project-oriented industry and one therefore that seems likely to benefit from the technical and interpersonal skills that a project manager has to offer. The traditional model of project objectives i.e. performance, cost and time (Barnes, 1989), provide criteria against which the success of a project (and the project manager) can be assessed. However, the increasingly complex demands being made on the construction industry by its clients have brought about changes in current thinking about project management. Indeed, Pinto and Kharbanda (1995) argue that client satisfaction is an undeniable fourth constraint of equal importance to time, cost and quality. Walker's (1996) comprehensive definition of construction project management serves to reinforce the point.

> *The planning, co-ordination and control of a project from conception to completion (including commissioning) on behalf of a client requiring the identification of the client's objectives in terms of utility, function, quality, time and cost, and the establishment of relationships between resources, integrating, monitoring and controlling contributors to the project and their output, and evaluating and selecting alternatives in pursuit of the client's satisfaction with the project outcome.*

There is also growing acceptance in many other commercial sectors that project management should be regarded as an "inclusive concept" (Cicmil, 1997) equally relevant to general organisational endeavour.

It is ironic that as other industries take a new look at project management, so the construction industry should seemingly be being urged to adopt a culture that adheres less to traditional contract based procurement and project management in favour of partnering, framework agreements and integrated project processes (Egan, 1998). Today project management is viewed as being an integrated process relevant throughout the project lifecycle. Egan (1998) is not asking the UK construction industry to look at what it does already and do it better. He is asking the industry to do things entirely differently.

This chapter considers how project management can contribute to improved performance in the UK construction industry and reviews recent initiatives aimed at enhancing the education and training of the project manager. Following a discussion of the requisite knowledge base of the project manager it is posited that innovative approaches to the delivery of education and training will play a vital role in developing further the skills of a project manager in a contemporary construction industry.

2.2 The changing role of the project manager

The need to improve performance within the construction industry has been an inescapable conclusion of many government and professionally sponsored reports in the 1990s. For example, Latham (1994) set a target of 30% real cost reduction by the year 2000. In 1998 the Construction Task Force, chaired by Sir John Egan, proposed a series of targets for annual improvement. These included annual reductions of 10% in construction cost and construction time, in addition to targets for reducing reportable accidents and defects by 20% per annum. The recommendations contained in the Egan Report rely in part upon evidence provided by the British Property Federation (BPF) and the Design Build Foundation (DBF). These surveys revealed dissatisfaction among clients with the performance of contractors and consultants and the need for reductions in capital and life cycle costs together with improved quality in new and existing buildings. The DBF suggested that these improvements could be achieved by integrating the design and construction process and echoed the findings of the RICS report "Improving Value for Money in Construction" (Atkin, 1995) in recommending that the construction industry align itself more closely with the functional business needs of its clients.

Controversially the Egan Report argues against conventional wisdom, that construction is different from manufacturing, taking the view that "not only are many buildings, such as houses, essentially repeat products ...but, more importantly, the process of construction is itself repeated in its essentials from project to project". Central to Egan's recommendations is the belief that through innovation, performance can be improved. He advocates an integrated project process that is sub-divided into "four complementary and interlocking elements":

- Product development;
- Project implementation;
- Partnering and the supply chain; and
- Production of components

Traditional competitive tendering is rejected in favour of long-term relationships or alliances that go beyond current partnering arrangements on "one-off" projects. The benefits of such arrangements in the public and private sector are well documented (CIC, 1997) and support for the creation of strategic alliances in the construction industry is becoming widespread. However, it has been argued that moves towards greater collaboration, undermine the need for project management (CITB, 2000). But project management is not a construction based procurement system. Rather it is a discipline that has evolved in order to plan, co-ordinate and control complex and diverse activities of modern industrial and commercial projects (Lock, 1999) from inception to completion (CIOB, 1982). Project managers therefore continue to have a key role to play in integrating projects, creating different organisational structures and cultures (Tyrrell, 1995) and ensuring that productivity gains can be attained. Somewhat provocatively Barnes (2001) states "Project management is the only type of management that matters".

Kagioglou *et al* (2000) make a distinction between the conventional view of a project manager and the new role of process management i.e. "the enactment of the process rather than the project". Drawing on the findings and recommendations of the Latham and Egan Reports, they describe a model, the Process Protocol, which recognises the interdependency of activities throughout the project lifecycle.

Production of project deliverables during each phase in the design and construction process is perceived to be a major factor in the success of a project and the facilitation and co-ordination of these deliverables (i.e. reports and documentation) arguably falls within the remit of the project manager. Jones (1999) states:

> *Project management is no longer about just managing a sequence of steps required to complete a job on time. It is about systematically incorporating the voice of the customer and working concurrently on all aspects of the project in multi-functional teams.*

His assertion sits very well within the "Rethinking Construction" philosophy, the introduction of an integrated process and the focus on an end product.

Cicmil (1997) believes that the emerging paradigm of project management represents a "renaissance of the discipline in a contemporary business context". The expansion of human knowledge, she states, creates "the need for an effective organisational design to support knowledge management for competitive advantage through intra-organisational integration, professional and functional concurrence based on project teams, inter-organisational networking and "win-win" partnerships in project situations". Project management is perceived therefore as having something new to offer organisations that are keen to improve their efficiency and effectiveness (Thoms and Pinto, 1999). Maylor (1999) states that modern business is characterised by change and that a project-oriented approach to management could be used to transform client need into some form of output (i.e. a systems approach). This generic view is shared by the APM (2000) who portray project management in the BoK as a process (refer to Figure 2.1) and similarly in BSI (2000) which describes a project management process characterised by project planning and control.

Maylor (1999) also recognises that the discipline is no longer dominated by the construction industry, believing that project management is applicable to all organisations. It is a view shared by Martin (2000) who states that project management is a relatively pure form of management that is becoming recognised as a key mechanism for business initiatives.

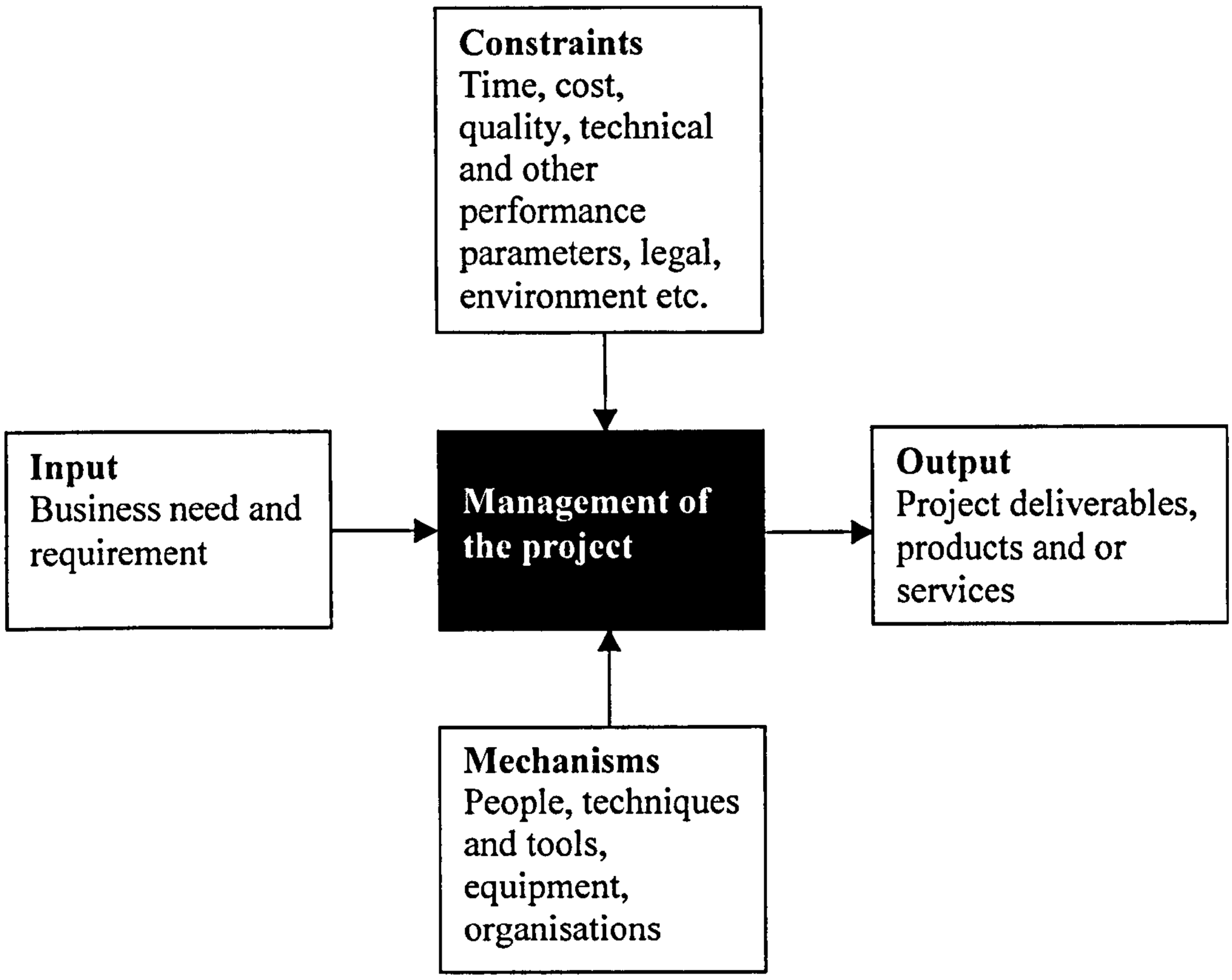


Figure 2.1 The project management process (APM, 2000)

Yet, this so-called "renaissance" is perceived to have had an impact upon the nature of project management and organisations. It cannot be seen merely as "an extension of a technical specialism" (Maylor, 1999). The project manager must take a "holistic approach", placing greater emphasis on the human issues and creative elements within a project. A strategic rather than a reactive stance is advocated by Maylor (1999) if business is to secure a competitive advantage. Moreover the same competitive forces dictate that project-orientated organisations must also recognise and address the shift to a knowledge based society and the need to improve their knowledge faster than the competition (Kotnour, 1999). In much the same way that individuals learn at the micro level, so organisations learn at the macro level.

The concept of the learning organisation, in which "raw data is subjected to group processes that produce from it behaviours that lead to corporate success" (Cabanis-Brewin, 1999), has evolved into a new discipline – knowledge management. Organisations, Kotnour (1999) observes, survive on the basis of their technical knowledge and the development of new knowledge from past successes and failures.

The need to learn from the past and adopt a forward-looking approach is developed further by Thoms and Pinto (1999).

> *The future of organisations can be shaped by forward-thinking leaders who create new paradigms.*
>
> (Thoms and Pinto, 1999)

If organisations are to compete in a global economy, project leaders must create the future instead of reacting to it (Thoms and Pinto, 1999). Hence their "temporal skills" should be attuned to the needs of the position, the organisation and the situation. The challenges created by this new competitive environment necessarily impact upon the education and training of project managers.

However, the need for project management education must not be viewed too parochially. Iles and Hayers (1997) provide examples of many international organisations who seek to gain competitive advantage through the deployment of trans-national project teams, that by definition work across geographical distances and across cultural barriers. Vickeridge (1995) predicts that the demand for people who can effectively manage civil engineering projects is world-wide as the population continues to grow. And the highly original work of Pheng and Lee (1997) serves as a reminder of the huge market for construction project management in the Far East. These are but examples of an overwhelming market for top-level management skills and expertise, much of which Briffett (1994) states, is drawn from overseas.

2.3 Lifelong learning in the construction industry

The Construction Industry Board (CIB), which was established following the publication of Michael Latham's report, is charged with improving the performance of the UK construction industry through the implementation of the recommendations contained in both "*Constructing the Team*" and latterly the 1998 Egan Report "*Rethinking Construction*".

Working Group 9 (WG9), one of twelve teams that were established to implement Latham's recommendations, produced a set of proposals aimed at improving the education of construction professionals. Lifelong learning is accepted as an essential characteristic of a practising professional. It is a recommendation supported by Cook's (1996) report "*Educating the Professional Team*", which emphasises the need to provide the requisite skills and knowledge to undertake the effective management of construction projects and construction business.

The Construction Industry Council (CIC) was subsequently appointed by the CIB to implement WG9's recommendations and following a study commissioned by the then Employment Department, the Training Organisation for Professionals in Construction (TOPIC) was formed. TOPIC's main strategic goals and objectives are:

- To identify, monitor and report on the strategic training and development needs of UK construction professionals and initiate action where necessary;
- To provide tangible support for members through the development of a network of local centres of the built environment; and
- To promote investment in people as central to competitive business performance.

(CIC, 1997)

In addition the CIC established a Memorandum of Understanding between each professional body and the CIB, based on a set of "Common Learning Outcomes" that all construction professionals could achieve. Each Memorandum promoted interdisciplinary working and teamwork as important factors in the success of any project. The CIB's recommendations are also viewed as being complementary to the Government's drive to promote education, the acquisition of skills and to develop a learning society in which everyone routinely is expected to learn and upgrade skills throughout their life.

The Movement for Innovation (M^4I) Board, working with the Housing Forum, the Local Government Task Force (LGTF) and the Central Government Task Force (CGTF)/Government Construction Clients Panel (GCCP), is charged with implementing the radical proposals set out in the Egan Report (M^4I, 2000b).

> *Lifelong learning is the process by which individuals in the workforce update and add to their skills. By so doing they can become more effective and better able to contribute to the competitiveness of the firm they are working for, and the construction industry, and also to enhance their own employability.*
>
> (M^{4}I, 2000a)

Lifelong learning is one of six "action themes" addressed in "*A Commitment to People*", which seeks to improve the construction industry's performance on people issues (M^{4}I, 2000a). The report focuses on the relatively low uptake of the Investors in People (IiP) standard in the construction industry i.e. only 10% of the construction workforce is covered by IiP compared with an industry average of 33%. One of the reports principal recommendations is that all stakeholders should commit to IiP as the most effective and systematic lifelong learning framework. Continuing Professional Development (CPD), the report states, is a key outcome of IiP. CPD demonstrates a tangible commitment to lifelong learning and career development. Among other so-called "pull factors" i.e. factors which make it easier to adopt new practices, is the development of on-line learning and information via the Construction Industry Learning Network (CILN) led by the CITB and the government-driven UfI "Learndirect" initiative.

CPD, as opposed to the broader definition of lifelong learning, is often viewed in terms of short training courses (Waterhouse, 1995), seminars and lectures. Samphire (1998) questions the effectiveness of this type of training for project managers. His findings, based on a survey of 50 leading companies, reveal that practitioners fail to put into practice the learning they acquire on "one-off" training courses and he advocates "short learning interventions interspersed with opportunities to put that learning into practice". It is a view shared by others (Van der Marel, 1998; Fraser, 2000). However, those employed within the construction industry have not readily accepted the culture of Continuing Professional Development (CPD).

> *Project-based industries, like the construction industry, are probably the most in need of a learning culture and yet may be the least open to such philosophies.* (Scott and Harris, 1998)

Watson (1997) acknowledges the delicacy of the situation. How do you persuade practising members of a professional institution who have carried out their duties, sometimes for many years after qualifying, to write down the hours they have spent over the year on continuing professional development? She concludes that for some it is perceived as an insult to their professionalism.

The CIOB, for example, require members "to keep themselves informed of current thinking and developments" Rule 13 of the "Rules of Professional Competence and Conduct") by a process of self-certification. Adcock (1997), past Chairman of the CPD Committee of the CIOB, states "There is a big weight of members who don't do it because they don't get asked to show their work. It undermines the reputation of the Institute and the good name of the industry as a whole". More recently Bale (2001) observes that the CIOB is moving away from the concept of mandatory CPD and is seeking partnerships with companies in order to promote lifelong learning. Bale (2000) also argues that problems have arisen because of the construction industry's size and complexity. There are, he believes, a confusing array of national and local organisations responsible for training and education. The creation of a culture of lifelong learning, he continues, may best be achieved at regional level drawing together initiatives such as the Construction Industry Learning Network (CILN) via regional Construction Knowledge Centres. This approach seems consistent with that outlined in the DfEE Education and Training Development Agenda 2000-01, recognising the need for co-operation with regional organisations such as the Regional Development Agencies and local TECs.

The Institution of Civil Engineers (ICE) recommends that every member maintains a Developmental Action plan and that a minimum of five days of CPD per year are recorded (ICE, 2001). The ICE state that "CPD is part of a lifelong learning process ... [that] will only work if you make the effort ..." (ICE, 2001).

Other professional bodies that have reviewed their approach to CPD include the Royal Institution of Chartered Surveyors (RICS). The RICS Education Task Force, in accordance with the Institution's strategic document "*Agenda for Change*", are currently reviewing membership progression in the context of major amendments to CPD regulations.

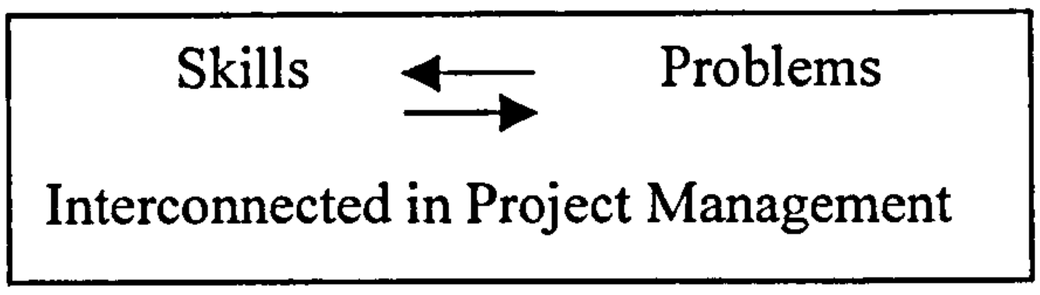
Among the options under consideration is the adoption of mandatory requirements for postgraduate study prior to gaining membership status. A successful bid for EU Leonardo funds has enabled the RICS to commence the development of CIT methods "to make CPD more easily attainable, particularly for those who are working in isolation and who have limited access to high quality post-graduate professional training and support" (CSM, 2001). Foster (2001) also notes that the £150 incentive currently payable through the DfEE's Individual Learning Account (ILA) scheme has encouraged members to pursue courses which can be used for CPD training.

2.4 Project management skills

Adham (1992) highlights a strong association between performance and the knowledge and skills required by a project manager. He concludes that the need for management knowledge and skills is of paramount importance and that the need for technical skills does not diminish at any stage in the project manager's career.

The Skills Mismatch Study (College of Estate Management, 1992) concur with this viewpoint. The study's findings reveal that education has an important role to play if the property professional is to acquire the necessary financial and managerial skills to make good the apparent skills mismatch in the construction industry. Pinto and Kharbanda (1995) argue that organisations pay too little attention to project management training and as a result "accidental project managers" have to learn by a trials and error approach. Furthermore, they contend that "many of these [project management] skills, though difficult to master, can be learned".

Quite what skills are required to be a good project manager has been the subject of much research. For example, Posner (1987) identifies six "clusters" of skills that make a difference in managing projects successfully and proceeds to match each of these groupings against a set of "critical problems" faced by the project manager. The model he subsequently developed, although acknowledged as an oversimplification of the dynamic nature of project management, nevertheless provides a useful classification of skills and their inter-relationship with the challenges inherent in the management of projects (refer to Figure 2.2).



Communication	Breakdown in Communications
Organisational	Insufficient planning
	Inadequate resources
Team Building	Team members uncommitted
	Weak inter-unit recognition
Leadership	Unclear goals/direction
	Interpersonal conflicts
Coping	Handling changes
Technological	Meeting ("unrealistic") deadlines

Figure 2.2 Skills and problems in a project management context (Posner, 1987)

In a review of education, training and research Willis (1994) concludes that a module in the principles of project management should include:

- The forms of project initiation (e.g. statements of requirements);
- Appointment of a project manager;
- The techniques of project management;
- Project strategy;
- Risk, change and conflict; and
- Team building.

Pinto and Kharbanda (1995) assert that the primary challenge faced by the project manager is managing people, therefore, many of the problems are of a behavioural rather than of a technical nature. Indeed Kliem and Ludin (1995) place people at the centre of Barnes' (1989) triangle of objectives. A project manager, they observe, should possess a mixture of both hard skills i.e. technical expertise, and soft skills i.e. people management.

These skills combined with "certain personal characteristics" (be they innate or acquired through experience) are necessary to be 100 per cent effective (Kliem and Ludin, 1995). Research undertaken by El-Sabaa (2001) suggests that project managers perceived "human skills" to be essential and "conceptual and organisational skills" i.e. mobilisation, communication, coping with situations, delegation, self-esteem and enthusiasm, ranked second in importance. Technical skill i.e. specialised knowledge in the use of tools and techniques, El-Sabaa (2001) concludes, is the least essential project management skill. Opinion remains divided regarding the level of cognate experience required by the project manager.

The distinction between the technical skills associated with project management and the personal attributes of leadership, vision and integrity is also acknowledged by the CIC (1996). In considering the question of certification in the area of construction project management, following the launch of the APM's certification scheme, the CIC defined a set of basic skills or competencies that must be demonstrated by any person practising project management. Competencies were classified as scene setting, initiating, planning, organising, communicating and executing, and commissioning skills.

One further means of identifying the criteria upon which the skills and competencies of a project manager should be assessed, is to resort to the professional institution's body of knowledge. Not that this is without problems. As Ward (1999) reports, there is widespread disagreement regarding the content in the Project Management Institute's Body of Knowledge (PMIBoK). The APM (2000) draws a similar distinction to the CIC, between knowledge (allied to personal experience) and attitude (behaviour). Despite the APM Body of Knowledge (BoK) seeking primarily to define the range of knowledge that project managers require for an understanding of the discipline, it does briefly outline the behavioural characteristics that are deemed important for effective project management. A project manager, they suggest, should possess a positive attitude, apply common sense and adopt an open-minded approach to new ideas and techniques. Moreover, a project manager should be flexible, avoiding rigid patterns of thinking, be inventive, be willing to take risks and have an over-riding commitment to the achievement of project goals.

Thoms and Pinto (2000) concur with the view that project managers should be flexible and goal orientated, but caution that individuals must also recognise the need to perform tasks like performance appraisal and budgeting i.e. tasks that require some reflection on the past. Just as projects fail when the project team does not understand the overall goals, so too do projects suffer when the daily problems and issues go unresolved (Thoms and Pinto, 2000).

Unlike the CIC competencies, the APM BoK adopts a generic approach to the discipline and provides a framework of 75 topics associated with project management. In accordance with the recommendations proposed by the Centre for Research in the Management of Projects (CRMP) at UMIST, the structure is quite simple with relatively few major headings, which give some indication of the project life cycle (Morris *et al*, 2000):

- *The project's strategic framework, including its basic objectives;*
- *Control issues that should be employed;*
- *The definition of the project's technical characteristics;*
- *The commercial features of its proposed implementation;*
- *the organisational structure that should fit the above; and*
- *issues to do with managing the people that will work on the project.*

Source: APM BoK (4th Edition)

Technical knowledge is incorporated in the BoK as it is considered that the management of technical matters is a major source of project failure (Morris *et al*, 2000). As such, the APM BoK is more broadly structured than the PMIBoK and that of the Australian Institute of Project Management (AIPM) reflecting more closely the BoKs of France, Germany and Switzerland (Morris *et al*, 2000). However, the framework does not assign equal importance to each "section". Knowledge associated with organisational and people management issues, continues to be recognised as being at "the very heart of successful project management".

Pheong and Keong (1999) offer an "Eastern" perspective regarding the development of effective construction project management. Managing people is seen as one of the principal skills of a project manager at both a strategic level and tactical level. Their analysis of "The Art of Management: Sixteen Strategies of Zhuge Liang" suggests that project managers should possess strong leadership qualities, thereby influencing members of the project team to commit to project goals. Discipline should be enforced at all times, so as to ensure that the project manager's authority is not side-stepped. Although the project manager should respect team members and understand their problems and feelings, it is essential that project managers remained unbiased in discharging their duties. Emotions should not obstruct objectivity.

The growth of project management as a separate discipline is reflected in the rapid increase in the number of HE courses containing project management modules and the expansion of training opportunities (Willis, 1994; Ward, 1999). Indeed in a review of qualifications, Underdown (1998) cites numerous awards that are available via the Association for Project Management (APM), the Project Management Institute Project Management Certification Examination (CPMP), the Information Systems Examination Board (ISEB), the Institute of Management "Modular Professional Development Programme for the Project Manager", NVQ/SVQ Levels 4 and 5 Project Management and a range of degrees and short courses.

Government recommendations outlined in the Green Paper: "*The Learning Age*" (DfEE, 1998) are perceived by Underdown (1998) to confirm many project managers' beliefs that there is "a real need to develop and educate project management professionals who are not only experienced but qualified to carry out their roles effectively. Arguably the most accepted professional project management qualification in the UK is Association membership". The benchmark membership qualification in the UK is the APMP, awarded on the basis of experience and the completion of two written examinations. Further grades are offered i.e. Member (MAPM) and Fellow (FAPM).

The majority of construction industry related qualifications are at "postgraduate level", perhaps reflecting the contention of a CIOB Working Party that extensive knowledge and experience of the building process is an essential prerequisite for persons assuming the role of project manager. Although the subsequent report published by the CIOB (1982) does not provide a syllabus for project management, the paper sets out criteria and guidelines for HEIs considering the establishment of programmes of study. Four course components are envisaged i.e. "core studies" developing conceptual principles, "functional studies" concerned with the building process, "new developments and research methodology" and "simulation and application studies".

Despite this seeming array of postgraduate awards and professional qualifications, the construction industry as a whole continues to debate the skills shortage issue (Knutt, 1997; Egan, 1998; TOPIC, 2000). Egan (1998) questions whether the industry possesses the skills necessary for improving productivity and concludes that there remain "significant gaps" at the project manager level. There is, he states, a "crisis in training" as "too few are acquiring the technical and managerial skills required to get full value from the new techniques and technologies".

The lack of management training in the construction industry comes as little surprise. For example, McIntyre (1992) acknowledges this problem and suggests that one reason why many construction professionals do not possess project management qualifications, is due to the fact that most studies are "tied down geographically and chronologically". Distance learning, he suggests, might offer a solution. McCartan (2000) argues that distance learning enables students not only to study in their own time and at their own pace but also allows programmes of study to more directly address employers needs and employees professional development requirements.

Certainly there is renewed interest in the HE sector regarding the potential of distance learning delivery, although the driving force behind such development is arguably concerned more with funding difficulties than meeting the demands of a changing work force.

In a review of postgraduate education, Harris (1996) comments on the relative growth of postgraduate compared to undergraduate students and notes the increasing use of off-campus and distance learning delivery either as part of a formal or informal programme of lifelong learning. The Harris Report (1996) states that lifelong learning is a "highly significant factor in the future development of the postgraduate sector" and, of direct relevance to the construction industry, "the increased demand from professional sectors, would necessitate academic input beyond the undergraduate level".

2.5 Innovation in educational delivery to support a new paradigm in project management

Lansley (1996) states that innovation is of vital importance to the sustained growth of the economy and that this can in part be achieved by establishing new philosophies of education and development. Kotnour (1999) promotes the concept of "Learning-by-doing" in a project management context. He applies the plan-do-study-act (PDSA) intra-learning cycle i.e. a similar cycle to that constructed by Kolb (refer to Section 1.4), to inter-project learning by providing a "routine, on-going store of data, information and knowledge" that is readily accessible on future projects (refer to Figure 2.3).

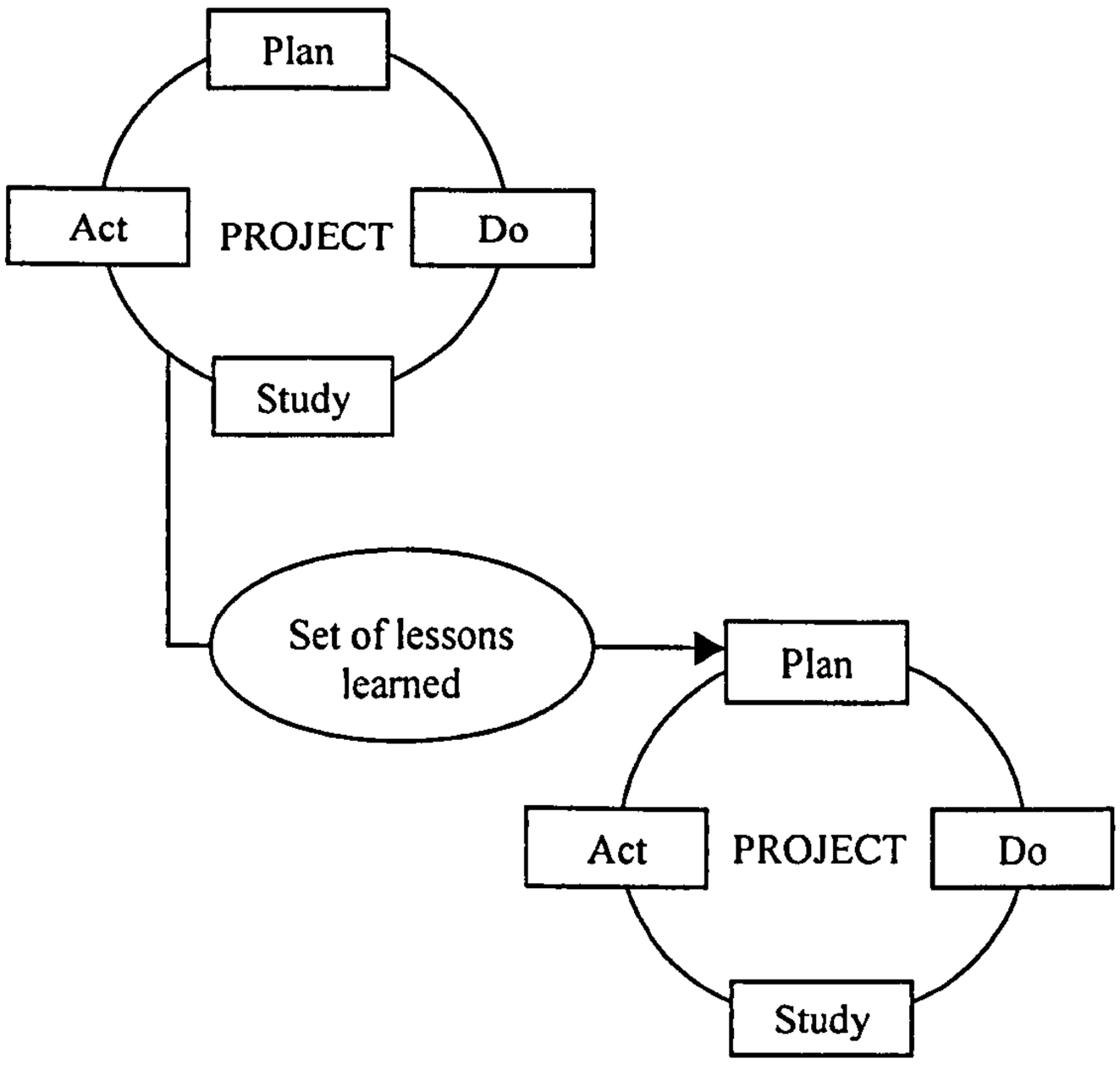


Figure 2.3 The Intra-project and Inter-project Learning Cycles for project management (Kotnour, 1999)

Although Kotnour's research considers the implications of experiential learning in the context of learning organisations, his findings are relevant to project management education in so much as he sees value in offering students the opportunity to reflect on project performance.

In order for the project manager to develop the necessary technical, financial, legal, human and practical process skills, Hicks (1996) found that students from engineering, scientific and technical backgrounds became frustrated with courses heavily weighted towards experiential learning. He suggests that a balance of analytical and experiential learning, and self-development exercises are necessary. Consequently the project management programme developed by Hicks (1996), which focuses on people issues and skills development, involves a mix of formal lecturing, extensive reading, experiential learning exercises and personal development awareness sessions. Yet both approaches to learning articulated by Kotnour (1999) and Hicks (1996) have a practical skills development bias. In attempting to promote the development of the reflective practitioner, the former relies almost entirely on project managers developing "lessons learned" through a review of task performance on projects undertaken within their organisation and the latter to a lesser extent upon "off-campus leadership camps".

Complementary to this on-going debate on the relative effectiveness of academic education and personal competence related project management programmes (Gunn, 1997) is the mechanism for knowledge access (CRISP, 1995). Shinkins (1995) recognises the potential of using computers to teach project management. She used "Project Interceptor", a commercial package employed in the business sector, to enhance the existing delivery format (i.e. lecture/seminar) of a final year, undergraduate engineering course. Interestingly, her evaluation reveals a positive emotional reaction among users to the package. Students particularly liked the clarity, user friendliness, structure and variety of tasks.

Although paper-based study materials still dominate the distance learning market, Knutt (1999) reports that CD-ROMs and web-based learning are becoming increasingly popular. Citing a number of construction related courses at Napier University, The University of Salford and Liverpool John Moores University, she concludes that "most universities" running distance learning courses already offer "PC-assisted" learning. The perceived benefits are linked to the use of on-line quizzes and forums that can reach a study group in so-called "world-wide virtual classrooms", and the apparent ease with which materials are converted to web-pages.

Edkins (2000) speculates that as the future of work changes, knowledge will become a "new and dominant commodity". The growing need to up date skills will in turn impact on education in the built environment.

> *The ability to receive this education [continuing education and skills acquisition throughout life] will alter as more formalised programmes for self-tuition and distance learning are made available through ICT [Information and Communications Technology]* (Edkins, 2000)

Martin (2000) provides an exciting insight into the potential of simulation and gaming as a means of supporting teaching in project management. A project simulation (Contract and Construct) is used to demonstrate the relevance and practical application of key theoretical concepts introduced elsewhere in the course. Using current technology and employing a range of interactive features, "players" are led through a project, following the selection of a suitable contractor, and presented with events as they occurred. A so-called "Situation-Response Option Consequence" approach is adopted as each response prompts a different set of consequences. Student reaction to the simulation, Martin states, is positive and has led to enhanced team-building skills.

Ahmed's (2000) evaluation of MERIT2, a simulation allowing participants to operate a construction company, supports these findings. Improved awareness of teamwork, communication and leadership are achieved, although its effectiveness as an educational medium is perceived to be greater for students undertaking a postgraduate course than industry participants using MERIT2 for CPD.

Hingorani *et al* (1998) acknowledge the need for increased teamwork if business is to improve quality, and argue that information technology-based teaching methods are more effective than traditional delivery formats in developing high-level cognitive skills in learning about project management. Lower-level cognitive skills, they state, are most effectively developed by the "lecture method". However the development of higher-level cognitive skills, which are necessary when a project manager is required "to interpret, analyse and manipulate information", lend themselves to active participation in complex real-life problems. Case studies they suggest allow students to gain vicarious experience in the classroom.

Hingorani *et al* (1998) differentiate between Written Case Study (WRICS) and Annotated Still Image Case Studies (ASICS). In a comparative evaluation of lectures, WRICS and ASICS, Hingorani *et al* (1998) employed video conferencing to "bring the project manager into the classroom and to motivate students to discuss and read further on the subject area". They conclude that ASICS is best suited to the development of higher-level cognitive skills. Consequently the written case study, used in their programme, was superseded by ASICS.

Walker (1999) argues that critical analysis of case studies can enhance the project manager's ability to "function effectively and in a way that meets the client's service quality expectations". In an analysis of two case studies that had links to the World Wide Web he recognises the considerable potential that the Internet offers in enhancing the quality of learning materials.

Added value, Walker (1999) contends, can be achieved by providing:

- On-line links to company web-sites and general information;
- Current information on the Internet; and
- Email links to tutors and authors of the information.

The benefit of case study research is not linked solely to postgraduate taught courses, as Walker (1999) also sees opportunities for practitioners to enhance their professional development needs via the web.

Adams (2000a) also believes that web-based delivery of formal education offers a new and untested opportunity for project managers, who by the very nature of their work, find it difficult to attend traditional classroom-based courses. Yet the delivery of an educational programme on the web, he observes, remains a controversial topic in America. Choice of courses is limited and web-based instruction is often restricted and experimental in nature. The strength of such provision lies in its ability to enhance access but the lack of face-to-face contact and the tendency to reduce spontaneity has resulted in universities approaching distance learning with some caution (Adams, 2000a). Winters (2000) expresses similar reservations. However, following an evaluation of a bespoke project management web-based program, he concludes that the adoption of a "cohort approach" i.e. allowing groups of students to progress together, can be used to encourage the sharing of ideas. So much so, that the combined advantages of "anytime/anywhere" access and the potential to integrate study in a work environment for adult learners, are perceived to outweigh the benefits of face-to-face interactions.

Adams (2000b) also supports the cohort-approach, recognising that this may enable students to form learning groups. But she draws a distinction between "university-style" education and on-line training. While project managers may be able to gain the necessary content via self-paced computer-based training, it is acknowledged that there may only be limited opportunity for interaction with peers in an industry setting.

Passerini (2000) conducted an experimental study in order to determine the effectiveness of technology-based learning in the delivery of project management training. Her evaluation of face-to-face instruction, self-directed learning and an interactive multimedia software application, reinforces Adams' argument that proximity to the instructor is a key factor in learner satisfaction. However, the distance learning materials used in this study were solely text based and the multimedia CD-ROM application provided a "stand-alone" tool for learning, which made no use of Internet resources or computer-mediated facilities. Passerini (2000) acknowledges the limitations of her study and recommends that mediated-delivery should be included in all project management training programmes principally by means of conferencing and other forms of synchronous communication.

2.6 Summary

If the construction industry is to resolve the problems associated with fragmentation through the use of long-term strategic alliances, this will, of necessity, result in the need to share knowledge between collaborating organisations and as a corollary, make new demands on education and training. Furthermore, the educational needs of construction project managers are becoming more closely aligned with their counterparts in the business sector. As many authors suggest this may bring about a new paradigm in project management. Such change, it is posited, will necessitate the adoption of new, highly innovative delivery mechanisms for learning and the re-design of project management education and training programmes.

O'Leary (1999) predicts that technology will radically change the "business of teaching" and that the benefits will be most evident to the adult population where home based learning is a serious proposition. Should this prove to be true, time devoted now to the development of high quality distance learning resources for the experienced project manager may be rewarded many times over. Advances in information and communication technology, in all its forms e.g. interactive CD-ROM, web-based learning and video conferencing, offers educational technologists the ability to respond to these demands, tailoring learning to the needs of a large and dispersed audience.

In order to determine the extent to which distance learning provision has grown and to gain further insight into the perceived merits and demerits of distance learning delivery, a survey of UK Built Environment postgraduate courses is undertaken in Chapter 3.

Chapter 3

Factors impacting upon the successful implementation of distance learning in the Built Environment

3.1 Introduction

Innovative approaches to the delivery of education and training programmes in the built environment are perceived to be of growing importance in satisfying the demand for new skills and in promoting a change of culture and practice in industry. An examination of project management education literature reveals that there is strong support for "hands-on" situated learning, physically remote from education providers. Examples of novel delivery methods abound as academics follow current trends in HE towards resource-based learning, either in distance learning or supported self-study mode (Twining, 1999). Yet there remains some doubt as to the uptake of these initiatives (HEFCE, 1999). Are they isolated pilot studies developed by enthusiasts or far-reaching approaches that are common to many academic programmes throughout the UK? Taking cognisance of the CIOB's (1982) recommendations that project management education should primarily be delivered at 'M' level and the stated research aim to determine the pedagogic effectiveness of alternative delivery techniques at postgraduate level, a postal survey is undertaken. The survey addresses the following questions:

- Has distance learning been adopted by built environment related postgraduate courses in the UK?
- If so, how has distance learning been implemented? If not, what factors have hindered such development?

This chapter describes both the design process and subsequent framework adopted by the questionnaire prior to an analysis of the results. Discussion focuses primarily on pedagogic issues associated with distance learning. Responses specific to computer-aided learning are analysed in Chapter 5, together with further empirical data which inform the design and development of the DIME^{PM} learning resource.

3.2 Method

Hoinville and Jowell (1978) suggest that having once established the specific aim of the survey, there are normally two further phases involved prior to undertaking its design and structure. Namely, to identify related subsidiary topics and to develop detailed data requirements for each topic. Oppenheim (1992) also recommends that for each topic a precise operational statement is required about the variables to be measured. To aid this process a "mind map" was used to assist in brainstorming related topics (refer to Figure 3.1) and a flow chart technique, as recommended by Hoinville and Jowell (1978) and Cohen and Manion (1994), was helpful in structuring the questionnaire (refer to Section 3.3).

Cohen and Manion (1994) state that the postal questionnaire is frequently the best form of survey in an educational enquiry as an interview survey often proves to be both expensive and time-consuming. The principal benefits of postal questionnaires, in the context of this survey are:

- Ability to reach respondents who live at widely dispersed addresses;
- Low cost of data collection;
- Low cost of processing; and
- Avoidance of interviewer bias[1].

However, Oppenheim (1992), who concurs with the aforementioned advantages, lists low response rates, a lack of opportunity to correct misunderstandings, and poor control over the order in which questions are answered, as the major disadvantages of this method of data collection.

[1] Oppenheim (1992) notes that respondents will interact with the questionnaire and that it may "project" some kind of person or organisation "behind" the questions, which in turn may bias their responses.

In an attempt to mitigate these "negative" aspects and maximise response rates, the process adopted for the postal survey adheres to the recommendations of Hoinville and Jowell (1978) and Jones (1980) (refer to Figure 3.2). Use is also made of filter and contingency questions to guide the respondent through the questionnaire (refer to Section 3.3).

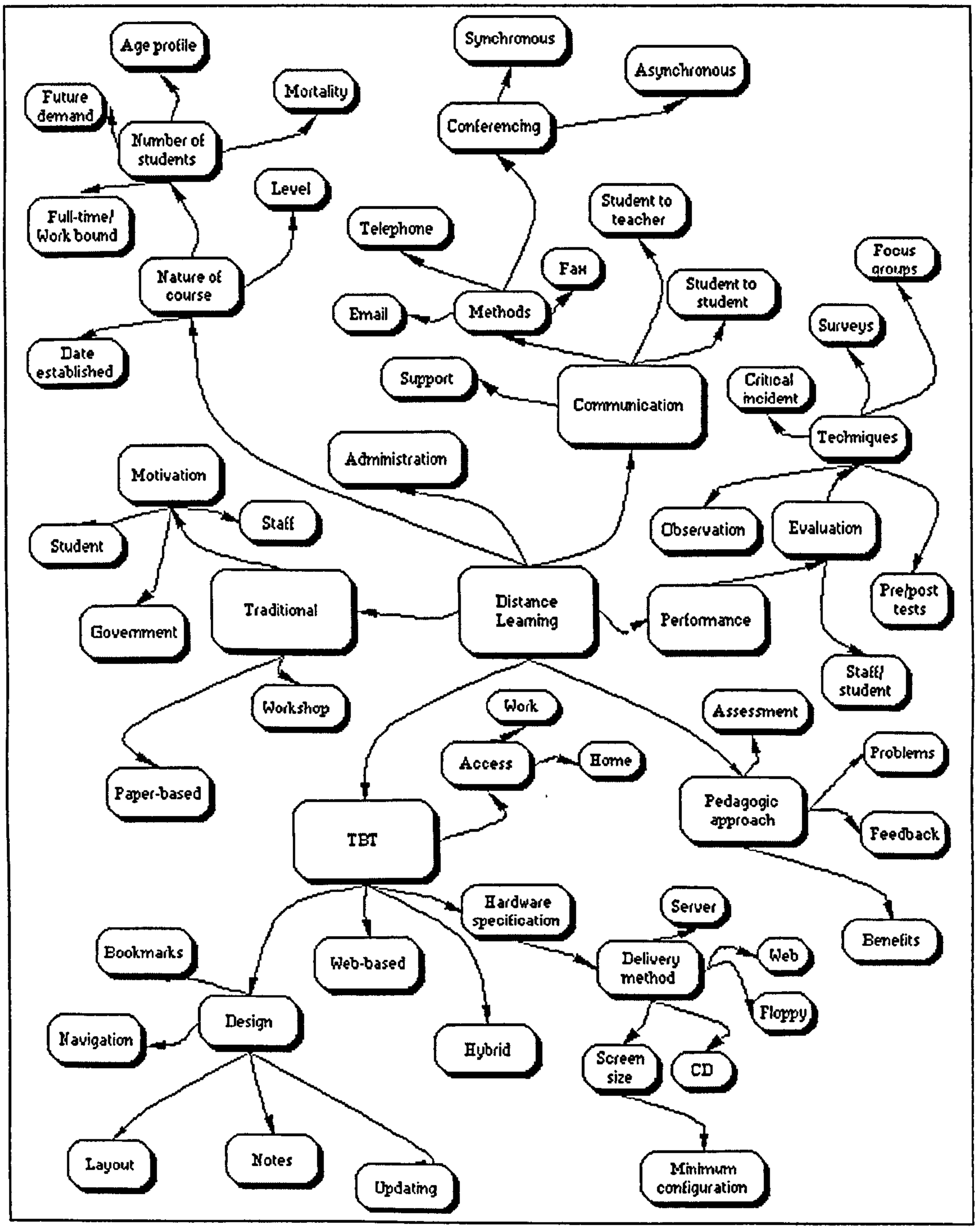


Figure 3.1 Mind-map (produced using Inspiration v4.0e)

3.3 Questionnaire structure and design

The tenets of a good questionnaire are identified by many authors (Hoinville and Jowell, 1978; de Vaus, 1986; Oppenheim, 1992; Fellows and Liu, 1997; Harvey, 1998a). Questions must be:

- Clear;
- Unbiased; and
- Avoid ambiguity.

Consideration must also be given to the type of data collection instrument, the method of approach to respondents, question sequence and type of question (Oppenheim, 1992). The questionnaire employs filter questions to enable respondents who have experience with distance, computer-aided and/or face-to-face delivery ("traditional") modes to record their perceptions of the relative benefits and problems associated with distance learning (refer to Figure 3.3).

Moreover questionnaires must engage people and be presented in an attractive, professional format (Hague, 1993). The presentation of the questionnaire is influenced by exemplars contained within PinPoint (refer to Section 3.5), the software application used for data processing, and guidelines provided by Leeds Metropolitan University (http://www.lmu.ac.uk/lskills/TLLS/entersite.html).

Questions in the introductory section are designed to be easy and interesting to answer, in accordance with the recommendations of Hoinville and Jowell (1978). They also suggest that repetitive attitude scales, usually found within the body of the questionnaire, should be staggered and that the topics should flow easily. The use of a variety of question formats is also recommended by de Vaus (1986) and open questions, in particular, should be kept to a minimum. Accordingly the design incorporates a variety of open and closed questions, Likert scales and ranking questions.

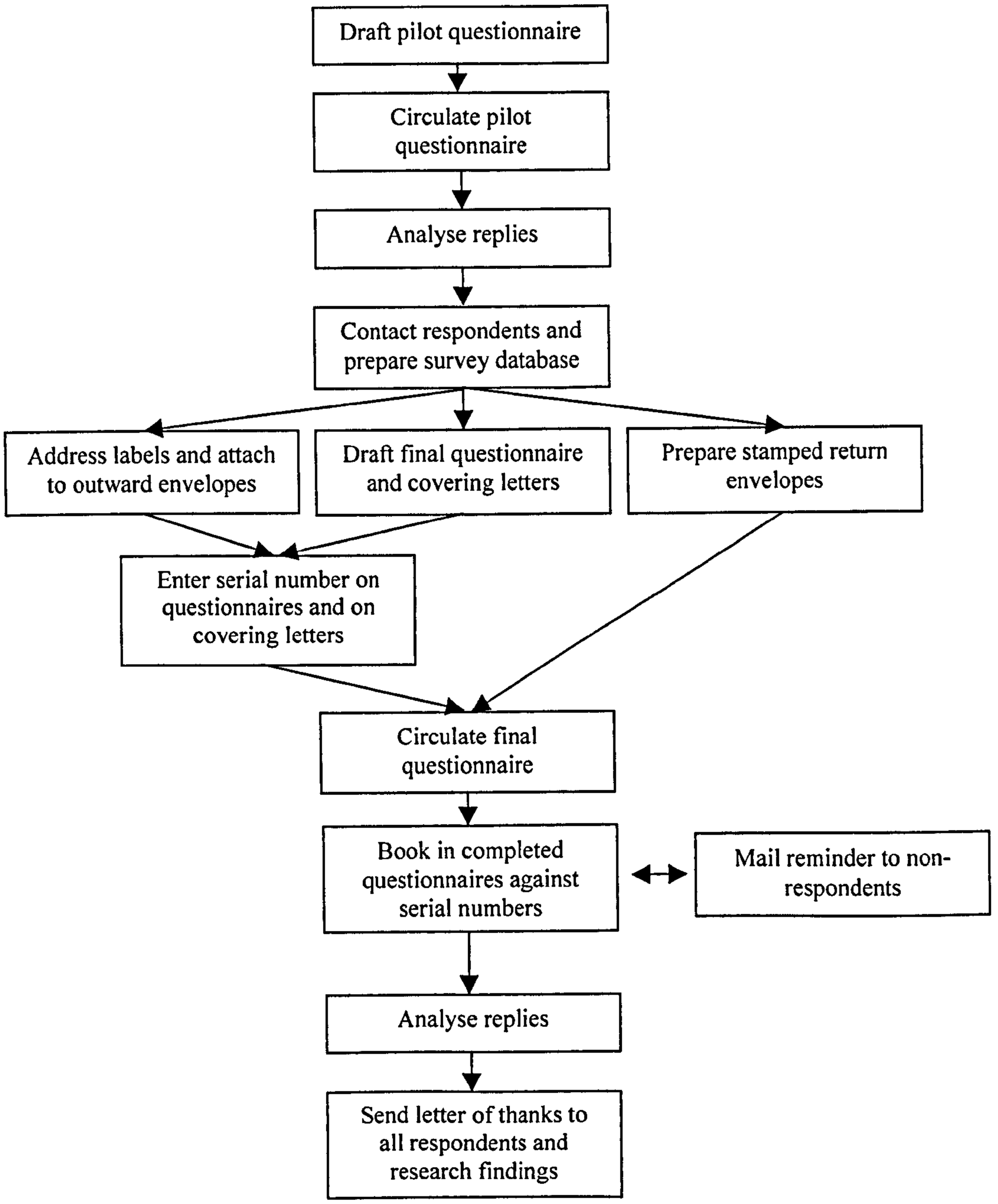


Figure 3.2 Questionnaire procedure (Source: adapted from Hoinville and Jowell (1978) and Jones (1980))

It is important, Hoinville and Jowell (1978) argue, that respondents are asked the same question in the same way and that their answers are recorded and coded uniformly. To ensure consistency, a 5-point Likert scale (1 "Strongly Disagree" - 5 "Strongly Agree") presented in diagrammatic format, is used throughout the questionnaire. Harvey (1999) believes that this approach offers a better range of options at the data analysis stage (refer to Section 3.7).

A time limit of three weeks was set following which reminders were posted to non-respondents in accordance with the recommendations of Fellows and Liu (1997). Further details regarding the sample and response rate are contained in Section 3.6.

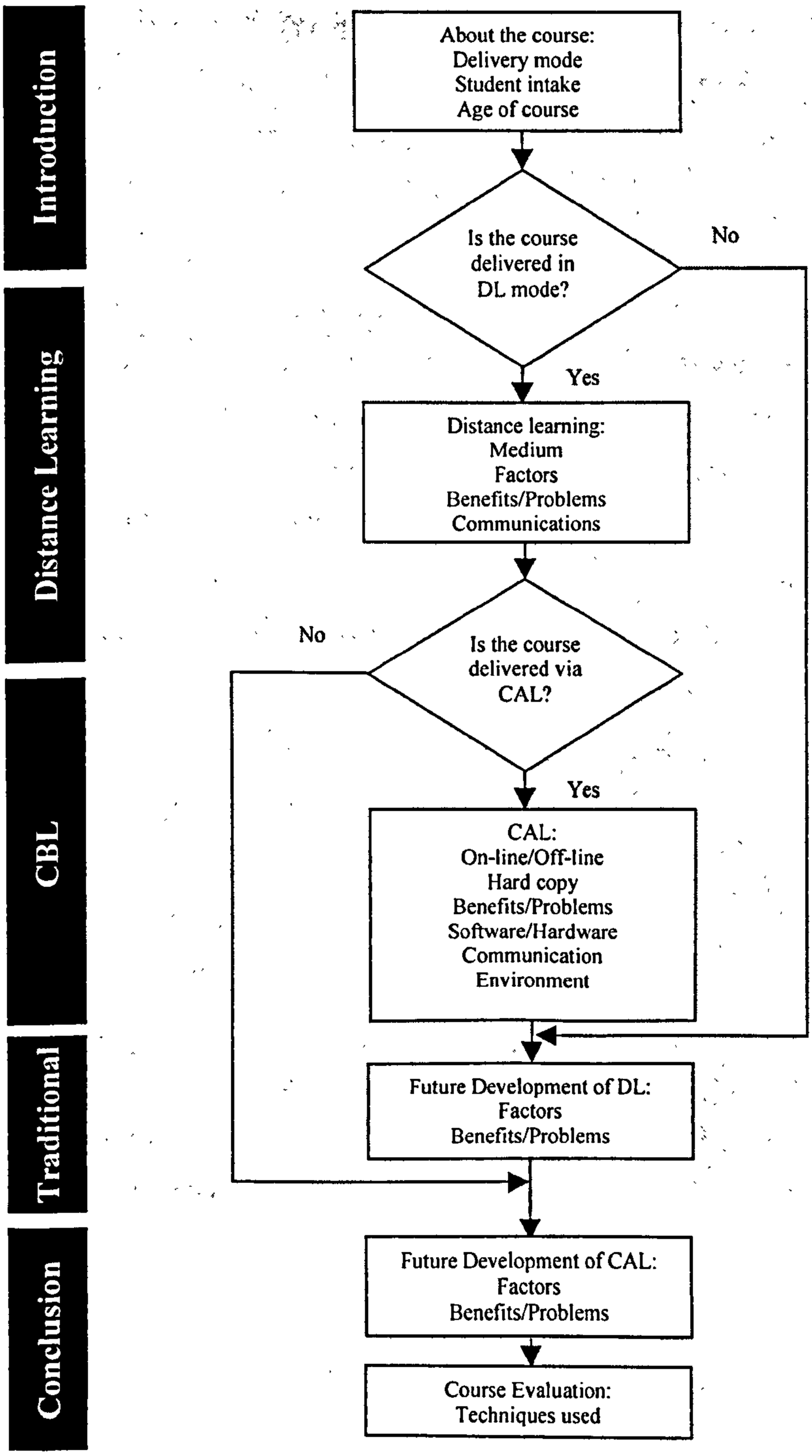


Figure 3.3 Questionnaire structure

3.4 Pilot questionnaire

As recommended by Fellows and Liu (1997), a pilot questionnaire was distributed to four postgraduate course leaders in the School of the Built Environment and two research active members of staff from the Centre for Urban Development and Environmental Management (CUDEM) at Leeds Metropolitan University. Two key issues were raised by respondents i.e. possible bias and ambiguity in ranking questions.

Firstly, there was concern that the sole inclusion of "benefit" statements implied a bias towards distance learning and that this could be addressed by the inclusion of open questions. A number of factors have to be taken into consideration when deciding upon the use of open or closed questions. A closed question is used to get at specific aspects of the issues and an open question to find out reasons for the respondents' opinions. Therefore, care should be taken to ensure that responses to open questions are not biased by the response alternatives provided by related closed questions (Fellows and Liu, 1997). De Vaus (1986), citing the work of Gallup (1947), suggests using them in combination. Accordingly, an open question was introduced in the questionnaire, following the rating scales, providing respondents with the opportunity to identify problems associated with distance learning.

Secondly, the wording of the ranked questions' rubric was considered to be "confusing". This too was amended in order to clarify the instructions given to the respondent. Minor amendments were also made to the structure of the questionnaire and the introduction of a "Don't know" check box was placed against closed questions. The final draft of the questionnaire is contained in Appendix A.

3.5 Preliminary analysis

The questionnaire was constructed using PinPoint v.1.0e, an information collection and analysis package, facilitating direct input of respondents' questionnaires. PinPoint offers limited analytical tools i.e. cross tabulations and charting facilities, but it is unable to produce box-plots and assist with coding responses to open questions.

Therefore all responses compiled in the PinPoint database were converted to Tab Separated Value (TSV) file format before being exported to SPSS v.10 (Statistical Package for Social Sciences) and SPSS TextSmart for further analysis. Neither SPSS v10 nor TextSmart accepts data directly from PinPoint. An intermediate stage is required. Data must be exported from PinPoint to Microsoft Excel and saved in .xls file format before being converted into an ASCI .txt file format.

3.6 Sample

"Post Graduate Listings" published by The Independent (1999) provided a database of postgraduate courses in the Built Environment. Course contacts were identified via the studylink.com web-site and a systematic review of all UK HEI web-sites listed on the Bulletin Board for Libraries Information Service (BUBL). In total 239 postgraduate built environment courses were identified. However, only 210 questionnaires were distributed following discussions with the relevant HEI course administrators. The reasons for this reduction in sample size were due to course closures in the 1999/00 academic year and the multiple ownership of courses i.e. where Course Leaders/Directors had responsibility for more than one course.

Estimates of response rates vary. Cohen and Manion (1994) suggest that a well-planned postal survey should obtain at least a 40 percent return and that the "judicious use" of reminders can increase this figure, whereas Fellows and Lui (1997) state that the expected response rate may be slightly less i.e. 30 percent. A high response rate was essential, therefore, each questionnaire was posted with a covering letter, explaining the purpose of the research being undertaken, a first class stamped addressed envelope and an offer to respondents of a summary of the research findings. Cohen and Manion (1994) recommend that researchers use this approach in order to maximise response rates. In total 87 (41%) responses were received from the initial tranche of mail questionnaires. One follow-up letter increased the return rate to 64% (overall), hence subsequent analysis is based upon a sample of 135 respondents. Fellows and Liu (1997) stress the need to keep records of how and when responses are received, as the follow-up may form another "cluster" of opinion. Therefore reference is made to the "initial" and "secondary" tranche, where appropriate, in the discussion.

3.7 Questionnaire findings

3.7.1 Delivery modes

Part-time attendance is the most common form of delivery. Although 61% (83) of UK postgraduate courses are delivered in multi-mode format, Part-time is available either as an option or as the sole delivery mode on 79% (102) of the courses in the sample (refer to Figure 3.4). Full-time education, also a popular delivery mechanism, is used on 73% (94) courses. Distance learning is available on 14% (18) courses and a further 4% (5) adopt open learning. Other modes of delivery i.e. block release and work-based learning, are available on 5% (7) of courses. A total of 129 responses were received i.e. 6 questionnaires gave a nil response.

3.7.2 Age profile of courses

The majority of courses (53%) within the sample have been running for between 1 and 5 years. However, 21 respondents either did not complete the question or qualified their response with an estimate of the likely age of their course. The maximum age recorded in the sample is 93 years. Distance learning delivery modes are not evident on courses established prior to 1984 (refer to Figure 3.5).

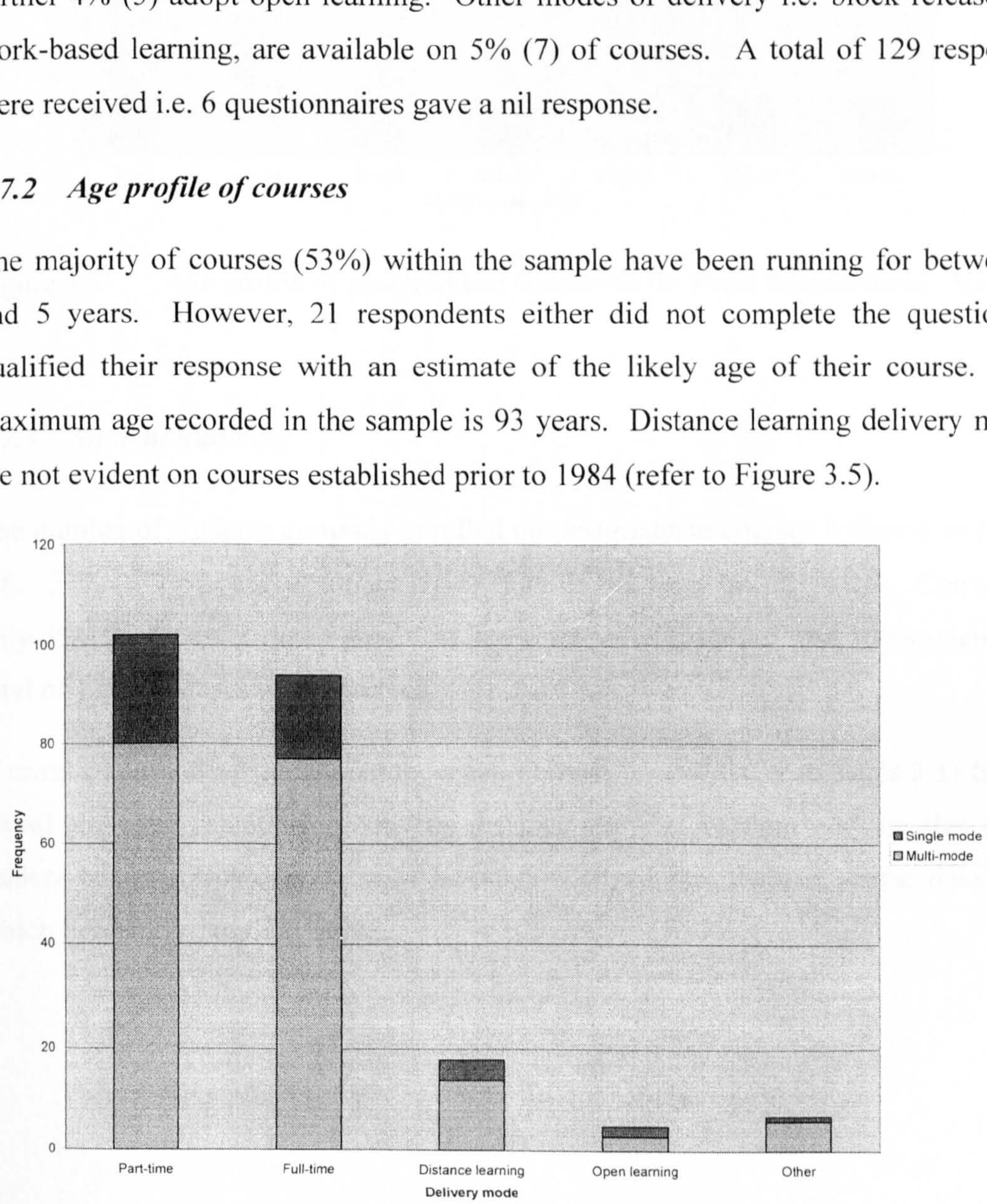


Figure 3.4 Postgraduate course delivery in the Built Environment (April, 2000)

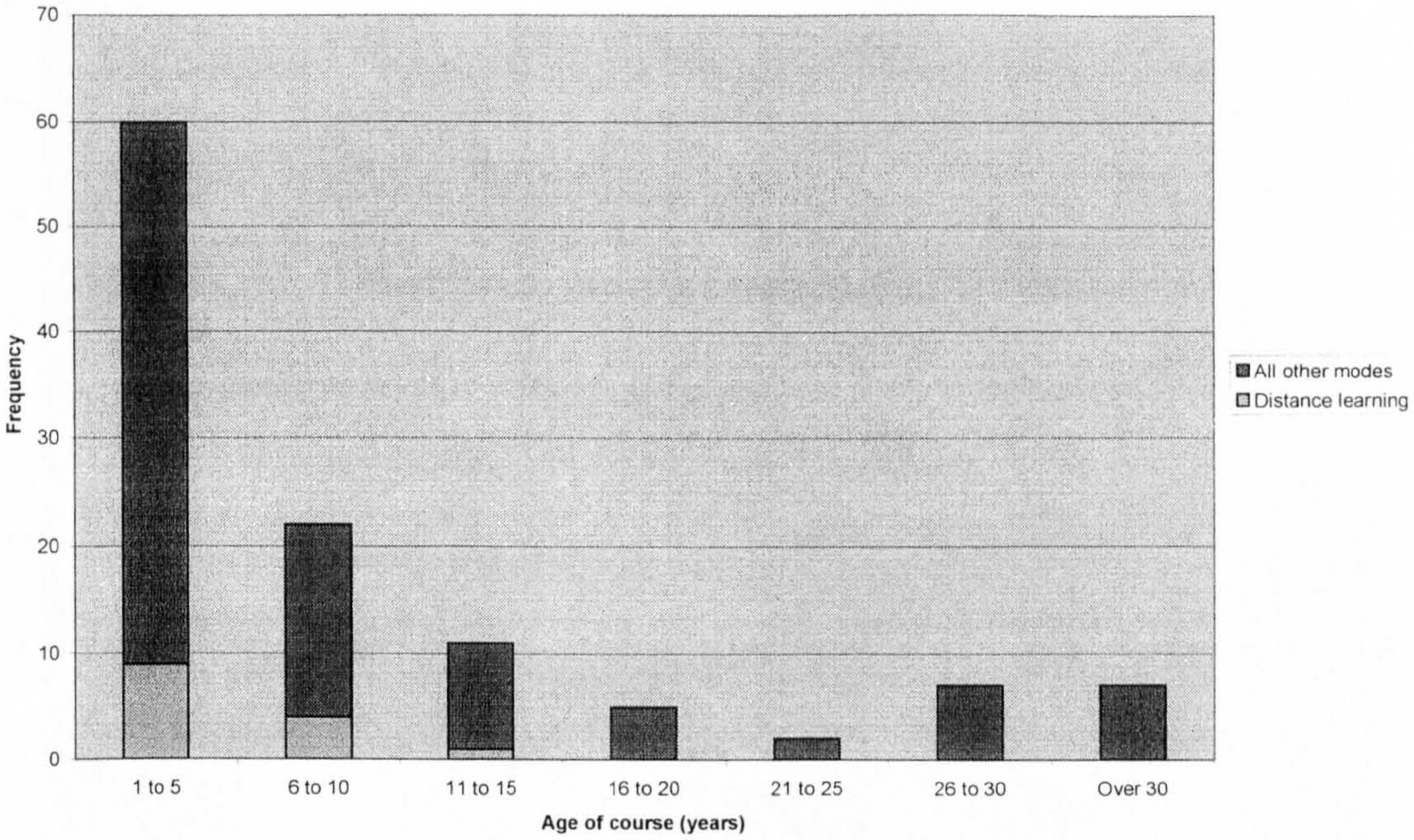


Figure 3.5 Age profile of postgraduate courses in the Built Environment (April, 2000)

3.7.3 Student numbers

The number of students currently enrolled on postgraduate courses is shown in Figure 3.6. 52% (67) of courses attract fewer than 25 students (in all years). Conversely only 4% (5) of postgraduate provision in the survey enrol more than 100 students. A total of 129 responses were received.

A cross tabulation of student numbers and delivery modes (refer to Table 3.1) fails to reveal any clear relationship between distance learning delivery and the size of the student cohort. However, it must be acknowledged that there is sparse data upon which to identify possible trends.

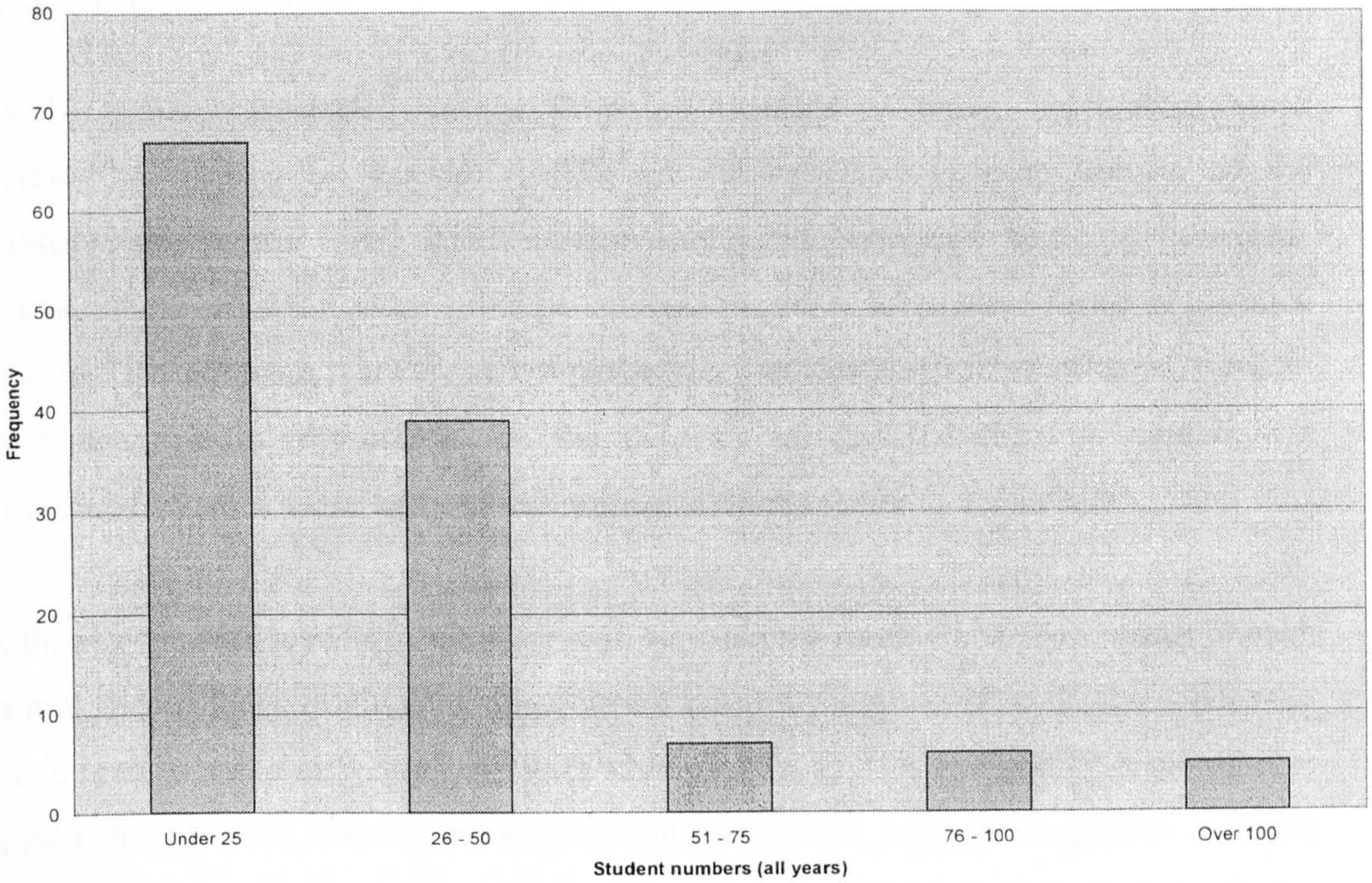


Figure 3.6 Students (in all years) enrolled on postgraduate courses in the Built Environment (April, 2000)

Method	Numbers					
	Total	Under 25	26 - 50	51 - 75	76 - 100	Over 100
Total	129	67	39	7	6	5
Part-time	102	55	32	4	4	4
	79%	82%	82%	57%	67%	80%
Full-time	94	53	24	4	6	4
	73%	79%	62%	57%	100%	80%
Distance learning	18	6	8	2	0	1
	14%	9%	21%	29%	0%	20%
Open learning	5	3	1	1	0	0
	4%	4%	3%	14%	0%	0%
Other	7	4	1	1	0	1
	5%	6%	3%	14%	0%	20%

Table 3.1 Student numbers and delivery mode (cross-tabulation produced in PinPoint v1.0e)

3.7.4 Learner benefits

Twelve statements, based on the proposed benefits of using "technology-based training" identified by Tucker (1997), are incorporated in each section of the questionnaire in the form of Likert-type scales, the intention being to determine whether there are differences in the perceived benefits of alternative forms of distance learning. Recognising that current course delivery modes may affect attitudes, the data from respondents responsible for the delivery of distance learning courses are distinguished from those without such responsibilities (refer to Table 3.2).

Although the data reveals few differences between the mode or median scores of each group, respondents responsible for courses currently delivered in distance learning mode tend to agree more strongly with statements a, c, d, h, i, k and l. It would also appear that distance learning students do not learn more, learn more quickly or retain more knowledge than their part-time counterparts. Yet it is acknowledged that students gain the benefits of studying at their own pace and at a time that suits them. Distance learning avoids the need for travel to the host institution and students are able to use the material for reference and revision. It is unclear whether students are able to make mistakes in private. This supposed "learner benefit" is commented upon in the subsequent open question.

3.7.5 Problems associated with distance learning

The questionnaire provides an opportunity for respondents, whether or not they are responsible for a distance learning course, to outline the problems associated with this mode of delivery. All responses were content-analysed using SPSS TextSmart (version 1.1.1). Data from PinPoint was exported to a Microsoft Excel 97 worksheet and saved in text (tab delimited) format. Minor formatting modifications to the worksheet were necessary as the survey file imported into TextSmart required a "Question ID", the "Question Text", a "Case ID" and the "Response Text".

Learner benefits		*n*	1	2	3	4	5	Don't Know	Median	Mode
a. Consistent message	*ndl*	83	10%	17%	29%	27%	7%	11%	3.0	3.0
	dl	22	9%	5%	32%	18%	32%	5%	4.0	3.0
b. Learn more[*l*]	*ndl*	86	19%	33%	21%	7%	0%	21%	2.0	2.0
	dl	22	18%	32%	27%	0%	5%	18%	2.0	2.0
c. Learn more quickly[*l*]	*ndl*	85	12%	39%	21%	5%	1%	22%	2.0	2.0
	dl	22	23%	23%	36%	9%	0%	9%	2.5	3.0
d. Knowledge retention is greater[*l*]	*ndl*	85	20%	25%	18%	11%	0%	27%	2.0	2.0
	dl	22	23%	18%	18%	27%	0%	14%	3.0	4.0
e. Study at a time that suits	*ndl*	87	2%	6%	3%	23%	62%	3%	5.0	5.0
	dl	22	0%	0%	5%	18%	77%	0%	5.0	5.0
f. Use as reference material	*ndl*	84	2%	7%	17%	39%	26%	8%	4.0	4.0
	dl	22	0%	5%	9%	50%	36%	0%	4.0	4.0
g. Use for revision	*ndl*	85	2%	8%	19%	39%	25%	7%	4.0	4.0
	dl	22	0%	5%	18%	55%	23%	0%	4.0	4.0
h. Learn by discovery	*ndl*	85	7%	6%	29%	31%	12%	15%	3.5	4.0
	dl	22	5%	5%	27%	50%	14%	0%	4.0	4.0
i. Learn at own pace	*ndl*	86	2%	5%	13%	38%	34%	8%	4.0	4.0
	dl	22	0%	5%	9%	41%	45%	0%	4.0	5.0
j. Make mistakes in private	*ndl*	84	8%	10%	31%	31%	13%	7%	3.0	3.0
	dl	22	9%	9%	41%	27%	14%	0%	3.0	3.0
k. Study what they don't already know	*ndl*	80	18%	25%	20%	15%	3%	20%	2.0	2.0
	dl	22	5%	23%	41%	18%	5%	9%	3.0	3.0
l. No need to travel to institution	*ndl*	85	13%	8%	12%	24%	39%	5%	4.0	5.0
	dl	22	0%	5%	9%	14%	68%	5%	5.0	5.0

ndl: course not delivered in distance learning mode

dl: course currently delivered in distance learning mode

l: distance learning relative to part-time delivery mode

Table 3.2 Learner benefits

TextSmart enables the creation of closed-coded categorical variables from the responses to unstructured open questions. However, the process is not fully automatic as the results depend largely upon the refining of included terms and aliases. A preliminary "Word Frequency" bar chart, on receipt of the first "cluster" of questionnaire returns, identified the 20 most frequently used terms in the survey.

The plot assisted in providing a "rough feel" for the kind of categories that the data would yield and identified words that should be excluded e.g. words that repeat part of the survey question. The exclusion list was supplemented with the words "distance", "learning", "need", "course", "student" and "problem", together with appropriate alias terms. The exercise was repeated, upon receipt of the remaining questionnaires in the sample i.e. the "secondary" tranche, to assess whether there was a substantive difference in the nature of replies. Nine words (and their aliases) remained in the "top ten" ranking, suggesting that the analysis could be based on the combined data (refer to Figure 3.7).

Following refinement of the package's excluded terms and alias lists and a review of the responses, automatic categorisation was adopted, thereby generating both category frequency (refer to Figure 3.8) and category plots (refer to Figure 3.9). Manual categorisation was used to assign eleven uncategorised responses, seven to the "Resources" category and four to the "Teaching" category. Five responses remained without a category. These responses, however, did not merit further analytical study as they were statements regarding the lack of experience possessed by the respondent.

Manual categorisation was also applied to those responses received from course leaders responsible for the delivery of distance learning. The responses were assigned to the "Experience" category to facilitate a comparison between the perceptions of the two groups. Redefinition of this category necessitated further manual categorisation of responses.

The categories generated by the "automatic" feature of TextSmart were renamed in accordance with the keywords identified in the category summaries. No limitation was placed on the maximum number of categories generated other than that which was inherent in the program[2]. However, in accordance with the recommendations contained in TextSmart's Operating Manual, the number of terms was limited to 20.

[2] TextSmart allows a maximum of 25 "Categories".

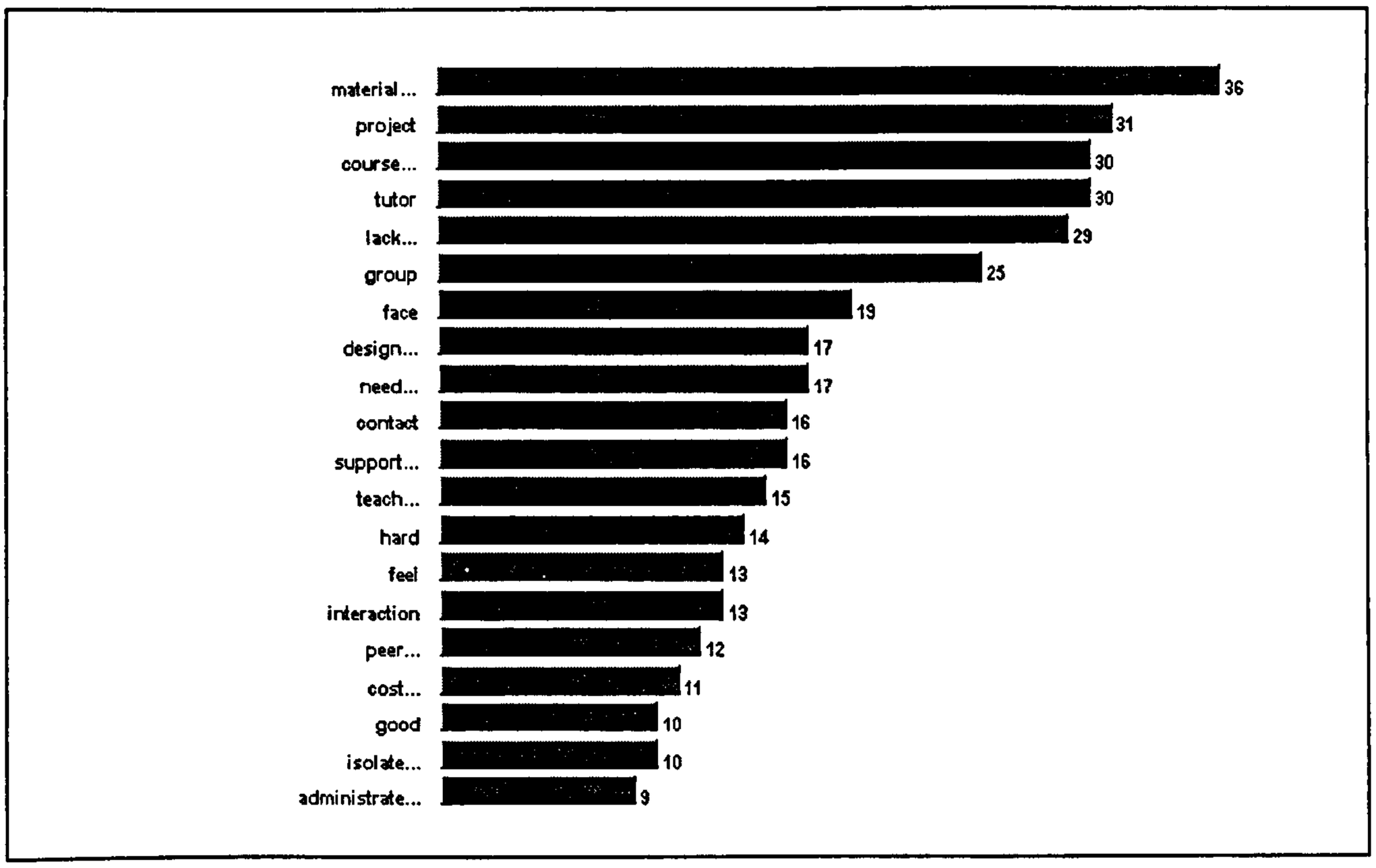


Figure 3.7 Word frequency plot (produced in SPSS TextSmart)

The primary concern expressed by respondents was in relation to the resources required for distance learning delivery [22, 24, 31, 54, 153, 187, 208][3]. Production of high quality materials was seen to be dependent on staff availability [17] and the appropriate allocation of time to create [83, 116, 138] and maintain the learning resource [74]. The need for "up-to-date" materials was a recurring issue [18, 25, 89, 130, 207]. Moreover academic staff, it was cited, may be unwilling to produce materials which were perceived to have limited use [69].

Financial considerations were also deemed to be a major constraint in the development of high quality provision together with the availability of external funding [66]. Emphasis was placed in the majority of responses on high start-up costs [17, 38, 49, 62, 64, 67, 96, 105, 153], but there was also recognition of an on-going financial commitment. The cost of updating learning material was often omitted in early cost feasibility calculations [51].

[3] [x] refers to respondent reference on the questionnaire return

> *Expensive to set up initially, with a lot of expense in advance which may not be recouped if only a small number of students take up DL [distance learning]* [69]

Administration was a pre-requisite for the efficient management of distance learning provision and was identified as a further cost heading [152, 157].

> *The organisation of distance learning is a major problem if the department providing the service is small. Furthermore, the appropriate administrative backup is essential for a course of this nature to be effective. We have several distance learning postgrad[uate] courses in the School which work effectively but they place a large amount of work generally on one member of staff which restricts teaching on other courses. It is also very hard to find the appropriate level of administrative assistance.* [61]

An external factor impacting on the production of learning materials was the relationship between the course and the accrediting professional institution - where the latter produced their own distance learning resources [17].

Lack of regular contact with tutors and other students was a recurring theme [5, 24, 49, 117, 121, 151, 203]. The inability of students to interact [51, 64, 89] and share experiences [2, 138] together with a sense of isolation, be it of a psychological or physical nature [16, 108, 112, 149, 161,176, 200] led to feelings of "loneliness" [23, 161, 169] and "coldness" [203].

> *Peer group learning and discussion is vital for the development of understanding and the testing of hypotheses in our field. Distance learning students learn alone or in partnership with just a tutor. Our students learn from one another face to face.* [100]

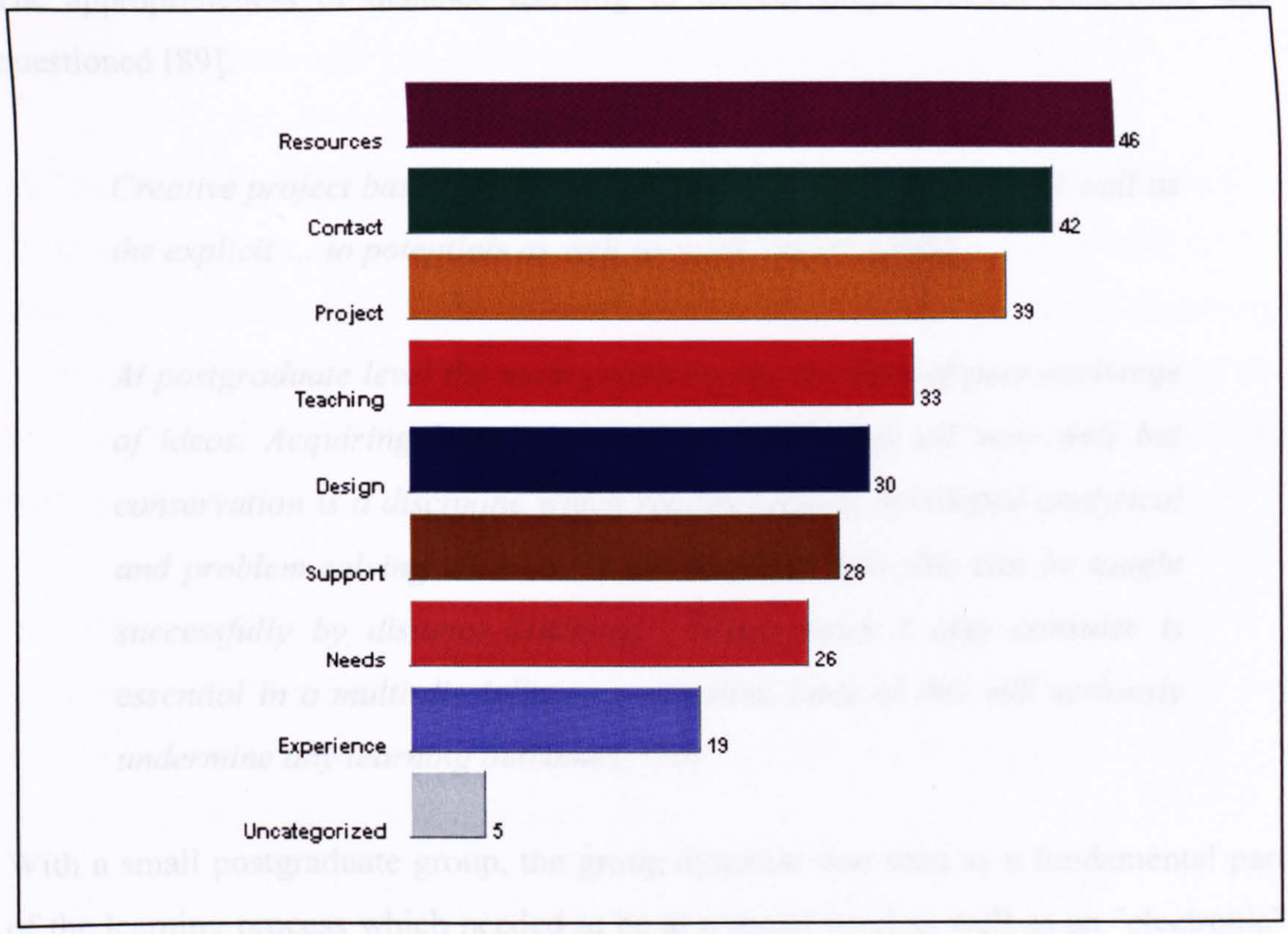


Figure 3.8 Category frequency (produced in SPSS Text Smart)

Student interaction with the culture of the academic department might also be impaired [102, 130]. Students did not feel that they "belonged" to the university [66]. Moreover the perceived lack of contact was detrimental to the tutor rôle and their confidence in students being able to pursue their studies diligently [206].

> *Attendance compels students to learn - regularly DL [Distance Learning] materials may be put aside where work demands compete.* [208]

Definition of categories requires qualitative judgement and, as is the case with these latter issues, there is a blurring of the boundaries between the automatic categories generated by the program. Faced with such, not unanticipated problems, the need for multiple categorisation seems appropriate. For example, project and design categories raise a number of different, yet inter-related, issues.

The appropriateness of distance learning to deliver project based education was questioned [89].

> *Creative project based work involves response to the implicit as well as the explicit ... to potentials as well as work "as is".* [198]

> *At postgraduate level the main problems are the lack of peer exchange of ideas. Acquiring knowledge and information is all very well but conservation is a discipline which requires highly developed analytical and problem solving abilities. I am sceptical how this can be taught successfully by distance learning. Group work I also consider is essential in a multi-disciplinary profession. Lack of this will seriously undermine any learning outcomes.* [30]

With a small postgraduate group, the group dynamic was seen as a fundamental part of the learning process which needed to be at a social level as well as an "electronic" one [125]. Respondents believed that the nature of the course was influential [4, 44, 148]. For example, one course [44] involved the sharing of experiential learning through participation and dialogue. The benefits of distance learning (referred to in Question 19) could equally be achieved through flexibly designed part-time courses. A lack of opportunity for group work, the difficulty of establishing a group identity and team working were cited as inherent problems with this mode of delivery.

Respondents responsible for design-based courses [76, 197, 199] e.g. architecture [62, 79, 117] and landscape architecture [177], also expressed concern regarding the appropriateness of distance learning delivery. Distance learning could not, it was felt, provide integrated group project learning, workshops or seminars [165, 169].

> *The strength of architectural education in this country is that it is project based with interaction between students and tutors taking place constantly within the design studio. It is dangerous to suggest that any architectural "design" education could be complete without this element.* [62]

> *I believe because of the nature of studio based design that it would be impossible to offer the course in a distance learning format.* [75]

Yet, research was being conducted into the use of CAL as a substitute for learning in a group based setting, focusing on the conceptualisation parts of design learning [177]. Interestingly, the concept of distance learning prompted a range of opinion regarding its pedagogic validity. On the one hand, respondents acknowledged the need to re-think the approaches adopted for the delivery and structure of the learning resource. For example,

> *Distance learning is not simply about transferring existing learning materials to this format. Creation of good quality distance learning materials takes time and the need for a change in thought processes. It's not as simple as "Chalk-and-talk".* [81]

On the other, the decision had seemingly been made:

> *The educational philosophy behind distance learning is wrong.* [41]

Distance learning could, it was argued, promote a bureaucratic mentality, "ticking off credits" [197] that was inappropriate in courses which were intentionally discursive [198].

> *Learning [on the respondent's course] is little about facts, more about developing interpretative positions.* [184]

Complementary to this issue were fears regarding staff abilities to produce materials that would maintain academic standards [191]. Comments such as "getting it right", "will it work?" were expressed. A perceived lack of a routine structure [201], organisational problems [187] and inadequate feedback would lead, it was suggested, to poor motivation.

> *I find that students on taught courses need considerable encouragement and assurance to make appropriate progress. I have concerns about the mysterious change which overcomes them to do all this themselves.* [54]

Complex concepts, it was proposed, were best handled in lecture/seminar mode where immediate response and feedback to students could be encouraged [91]. Spontaneity would be inhibited inside and outside the classroom environment [153]. Likewise, the structure and organisation of academic research essays should take place in tutorials and design activity was best suited to studio and workshop sessions [91]. Skills development would also be difficult to address [200]. The learning environment was variously described as being "boring" [152], "poor" [200], "sterile" [149] and as previously stated "cold" [203]. Distance learning materials therefore must be interesting, one respondent observed [191]. Motivation of students was a key issue [38, 124, 200, 210].

With little opportunity to debate or to challenge concepts, the learning experience was weakened [127]. The need for supervision and face-to-face contact, to resolve the problems created by assignments and the like, was perceived to be a major issue. Other concerns surfaced regarding the authenticity of the work students might produce [45] and the difficulty students would have in gauging the level and standard of the work they produced. For professionals, seeking to gain qualifications through distance learning, these problems may be a greater concern. So too would be the amount of self-discipline and study time required to complete educational programmes [71].

Students learn from other students' experiences, and in seeking to alleviate this apparent in-built lack of contact, further problems may arise as a consequence [93].

> *Higher levels of individual feedback tend to be required.* [127]

> *Need for high degree of communication between staff and students ... can lead to staff being diverted from other work.* [16]

The issue of feedback [66] must be considered both from a student [96] and staff viewpoint, the latter being raised in relation to the difficulty experienced by the teacher in assessing how the teaching is being received [155, 203] and the timeliness of feedback [130, 200]. Evaluation of the learning process that students had come through [155] would also prove problematic and the difficulty in assessing how teaching had been received may undermine the confidence of the teacher [203].

Support was linked with access to university facilities i.e. technical and library [25, 74, 130, 133, 152], administration [14, 66, 74], peer support [27, 74] and supervision [170]. Restrictions that were necessarily imposed by distance learning [18]. Other issues identified by respondents, in this category, included pastoral support and the early detection of problems [40, 152]. Support systems were required to distribute and track progress thereby ensuring student participation and engagement [54]. In essence there was a perceived lack of a holistic learning environment i.e. lecturers, libraries and related course events [124].

Much of the above comment focuses on the problems raised by academics not currently responsible for distance learning delivery, but the final category outlines the collective view of academics responsible for courses that adopt this delivery mode.

A commonly expressed benefit was the greater accessibility afforded by distance learning. However, problems had arisen both in the delivery of materials to students [115], including those in "less than accessible places within the same time frame" [32], and in ensuring that the materials and student requirements were understood. Coursework production and tutorials, it was stated, were not well suited to the format [115]. Resource related problems echoed those raised by respondents earlier in the discussion. Updating and revision remained important issues [47, 112]. Obsolescence was the likely outcome, without expensive revision [190].

Staff were not always familiar with the mode [63] and delivery of the courses was found "to be very time consuming for the tutor" [57]. There was front loading of "teaching effort" as the resource was prepared [196] and such work demanded new skills [138]. The "emotion" of delivery was lacking and it was considered difficult for students to gain a feel for what was important [110].

Encouraging and monitoring the development of skills [58] was identified as an issue and concern was expressed that distance learning "spoon feeds students" [190].

Contact remained an issue [63]. Difficulties were experienced when clarifying problems [57] and communicating alternative solutions and explanations by email.

> *Interaction by email is not as good as face to face discussion.* [37]

> *The students find it difficult to assess the level and standard of work and how they are progressing.* [71]

It was felt that this resulted in students learning less and less quickly, and that the learning was not reinforced to the same extent as part-time equivalent students. To counteract these problems, higher levels of individual feedback tended to be required [58]. Students could hide mistakes and disguise weakness [58]. Similarly, tutors were concerned that they too might not be able to determine whether the students were progressing with their studies.

> *Contact with students, except when something goes wrong, or prior to hand-in dates, is missing. One suspects that the students have failed to take up the materials. This should lessen with web-based learning when one can track when individual students have logged on.* [48]

Again, isolation and lack of group communication were cited as problems [71] and maintaining the momentum in the learning process [115] was highlighted as a concern. It was noted that students required commitment, self-discipline and dedication [57, 138].

Administration [14, 82] was a recurring theme, together with technology "glitches" such as the integration of internet-based courses into university systems designed for on-campus students [82]. Organisational support in the production of "quality learning materials" [47] could not be neglected.

Students experienced problems gaining access to computers at home and at work, and in the on-going management of systems, when problems of a technical nature occurred. Support was needed [135]. Where international students were involved, the issue of student support was particularly important [106] and the availability of complementary learning materials in some places of the world further aggravated support related issues.

A categories plot (refer to Figure 3.9) using multidimensional scaling (MDS) in two dimensions, indicates approximately how likely pairs of these terms co-occur (SPSS, 1997). The inter-relationship between design, projects and course issues are reinforced, as are administration, support and cost. Contact and "face" are located in similar positions on the plot. So too interaction and group issues. The plot also suggests that a further classification might be appropriate i.e. "hard" issues linked to administration, materials and course development, and "soft" issues linked to face to face communication, pedagogy and group interaction. Despite the inherent distortion that can occur in creating such a plot (SPSS, 1997), it is contended that it is useful in suggesting relationships between terms.

It may seem trite to observe that there is a strong co-occurrence of design and project categories, but it is evident that architectural related courses form an important and distinctive sub-group within built environment provision. One respondent states:

> *Contact is essential. Architectural study cannot rely on chance or accidental discovery. "Mistakes" are a necessary learning process and should be discussed. Architecture is a collective, visual experience not a private introspective one.* [117]

The plot therefore serves as an important reminder to take care in generalising the findings of the research to all aspects of built environment provision and to recognise the need for further discipline-specific investigations.

Figure 3.9 Category plot (produced in SPSS Text Smart)

3.7.6 Evaluation techniques

The majority of respondents (87%) used questionnaires to evaluate course provision. 36% of respondents relied on focus groups and 33% observed student behaviour. Clearly, a mix of evaluation techniques was favoured, although little use was made of pre-tests, inventories and critical incident logs (refer to Figure 3.10). In addition to the traditional post-tests (13%), respondents cited a range of other means by which feedback was gained on course provision. These comprised variously named committee meetings i.e. course boards, team meetings and course committees, employer reaction via advisory boards and "Employers Forums", and a series of reporting procedures in the form of "internal" Annual Reports and External Examiner Reports. Less frequent approval-style events and critical appraisals, at times of re-validation, were cited as mechanisms for reflecting on course performance.

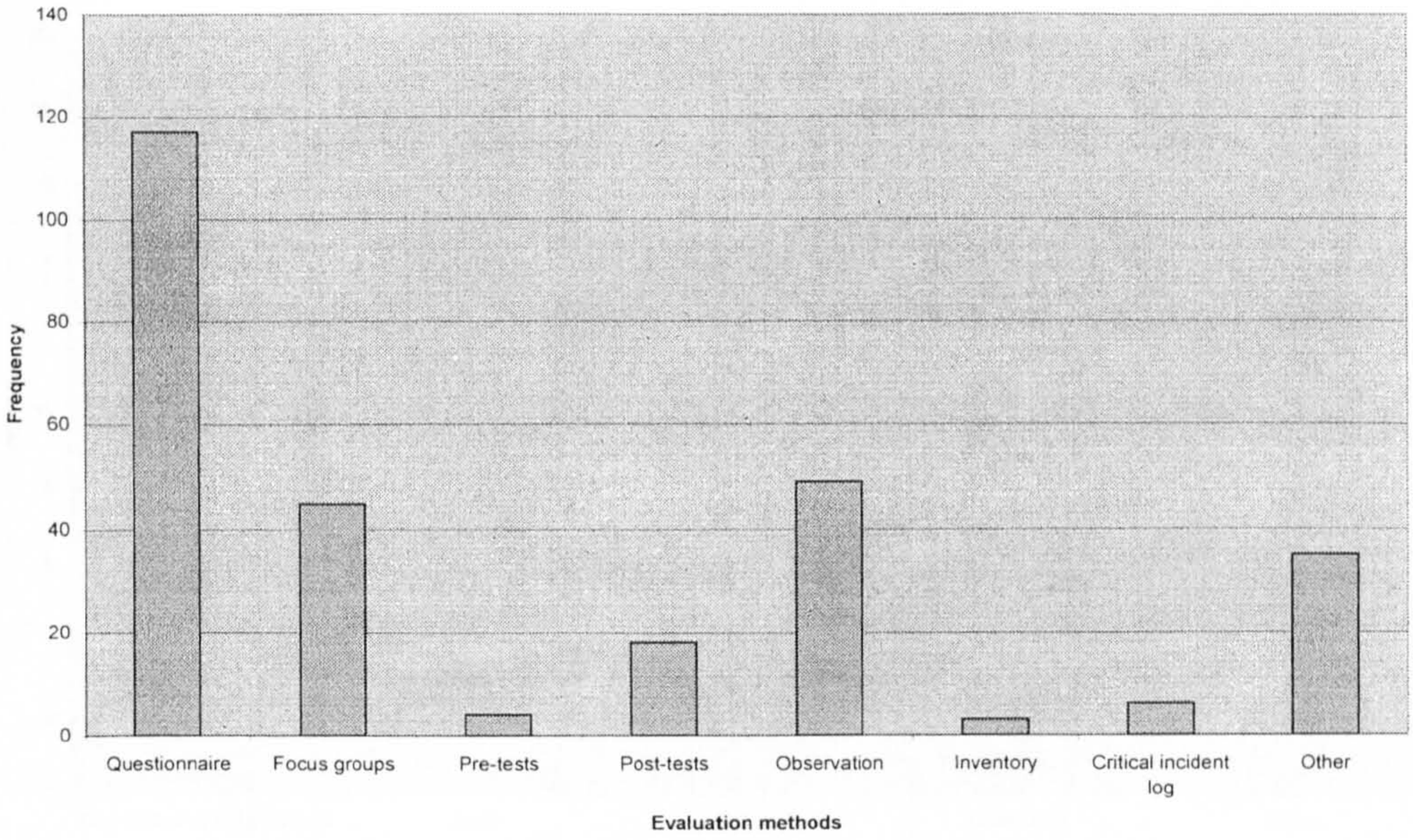


Figure 3.10 Course evaluation techniques

3.7.7 Distance learning delivery mechanisms

All courses that adopt a distance learning approach (18 No.) use text-based media. However, a multiple media format is popular among the surveyed courses (refer to Figure 3.11) with computing and video learning materials being made available to students. Little evidence of audio-based resources is revealed by the survey.

3.7.8 Distance learning communication

Respondents currently delivering distance learning courses were asked to rank the frequency with which various forms of communication were used by students to contact staff (Question 8). Communication via email and telephone were the most popular forms (refer to Figure 3.12).

Relatively little use was made of synchronous computer-aided communication e.g. video conferencing. Once again the sample size is small (16 No.), two respondents submitting a nil response to the ranked question.

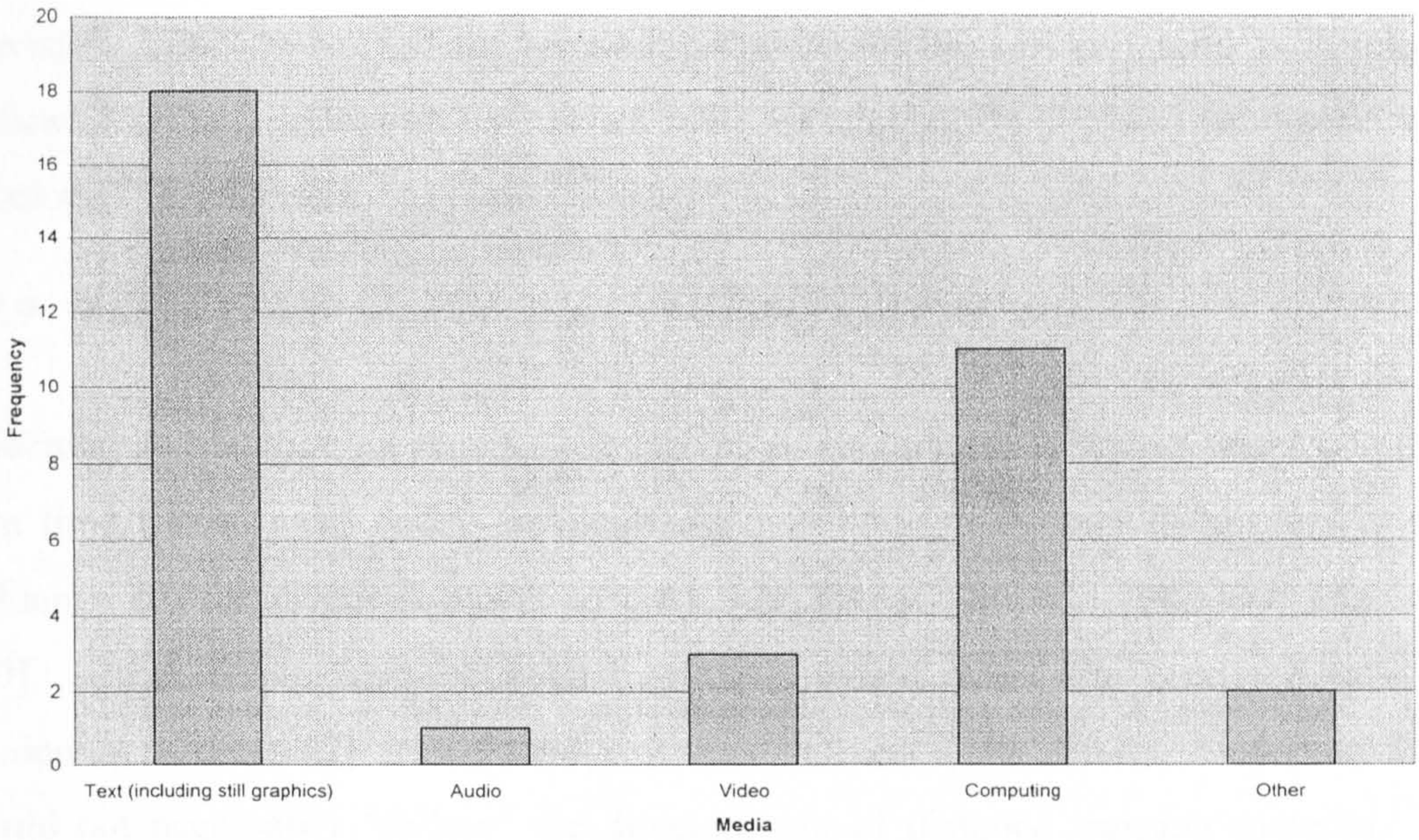


Figure 3.11 Media used in delivery of distance learning courses

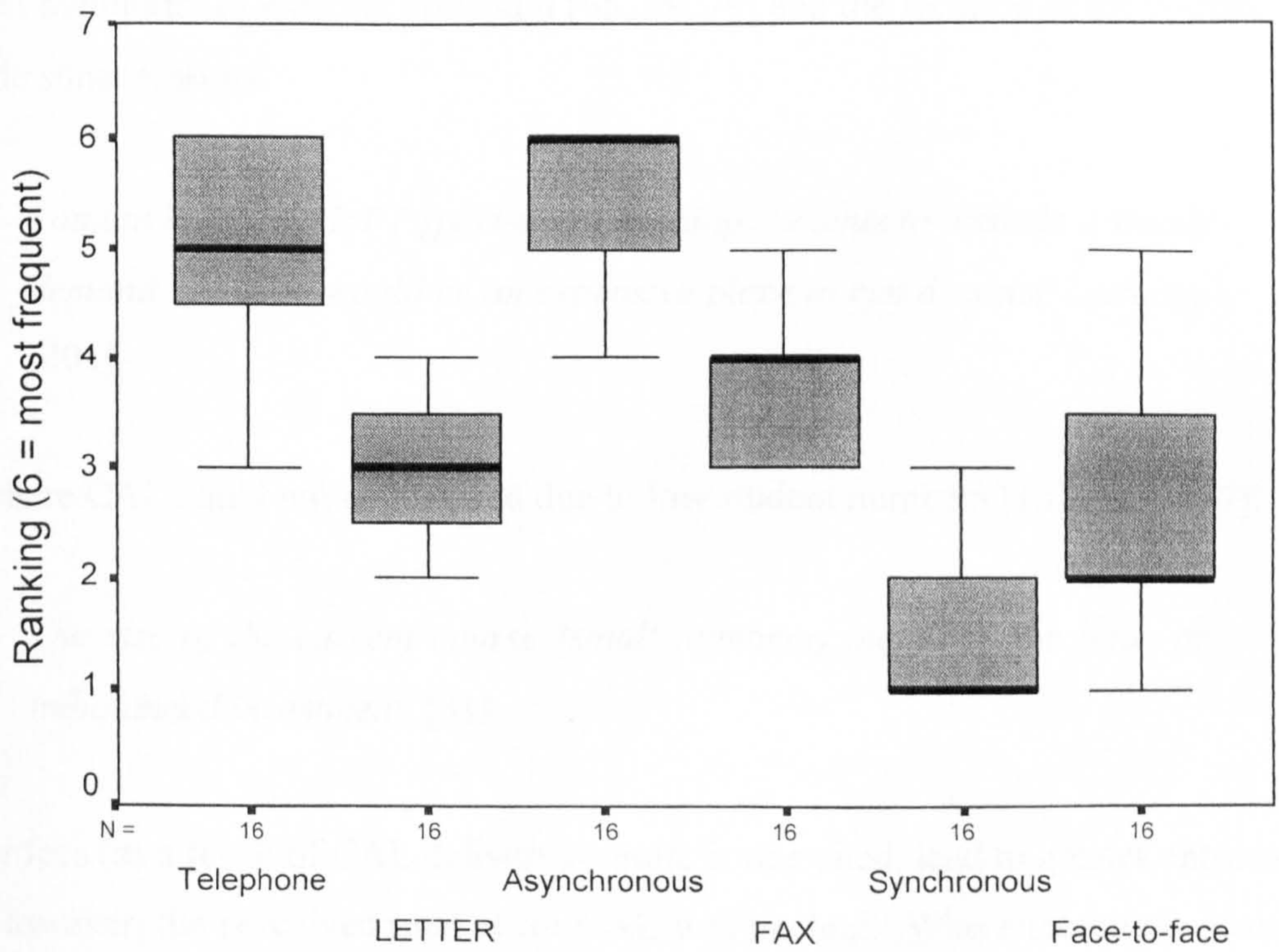


Figure 3.12 Forms of communication (produced in SPSS v10[4])

[4] Boxplots show the frequency distribution , displaying the median and quartiles

Despite the relatively low level of distance learning in postgraduate built environment provision, 27% (29 No.) of the remaining courses in the survey intend to develop a distance learning mode prior to October 2002, of which 59% (17 No.) were seeking to develop CAL materials.

3.7.9 Future development of distance learning and CAL delivery

Widening and facilitating access i.e. enabling more students to access courses in their own time frame, were widely acknowledged as being important factors that would influence the future development of CAL [22, 23, 58, 80, 81, 108, 109, 148, 190, 200]. Other respondents believed that CAL would avoid the need for full-time residential courses [2] and extend overseas delivery [108, 152]. However, CAL would not necessarily "follow" the development of distance learning material. On occasion it might be the catalyst for such development [153]. Respondents in the sample who were not intending to develop CAL did not raise access as an issue.

Current popularity of existing provision [65, 69, 79] and the location of the course provide some reasons.

> *London has enough PT [part-time] evening students to provide a steady demand. London would be an expensive place to run distance learning.* [201]

Elsewhere CAL could not be justified due to low student numbers [102, 125, 157].

> *The size of the current course (small numbers) makes it, for now, an imbalanced investment.* [31]

Lower fees (as a result of CAL delivery) would, it was cited, lead to greater enrolment [27].However, the perceived market for CAL was unclear. Where there was demand for CAL [32, 116, 210] this was in part attributed to the competing demands on students of work and family commitment [40] and in part due to competition from other providers [152, 210]. Those respondents not currently intending to develop this form of learning resource [133, 137, 184] queried the need for CAL.

> *At present there are very few indicators that this market exists.* [71]

On occasion, the catalyst for the development of CAL resources had been the result of university policy [187] and funding [55, 81]. CAL was considered as being resource efficient [76, 80, 116, 188], a cost benefit [109] and easier to prepare, amend, duplicate and dispatch [208]. Another respondent, stated simply "it saves paper" [153].

Conversely, a lack of resources [14, 18, 54, 106, 133, 203] i.e. staff time [4, 28, 46, 106], development time [49, 71, 120, 177], internal funding [64, 191], external funding [37], expertise [64, 177], administration [65] and the relative age of the course [37], had influenced others not to develop distance learning or CAL resources. Moreover, day to day administrative, management and pedagogic requirements prevented academics having time to implement new ideas [38]. "Apathy" was cited as another factor [156], as was "initiative overload" [54].

> *There needs to be a critical mass amongst the team. The biggest drawback to implementing distance learning mode is lead time needed to develop the materials and knowledge required to take the concept forward.* [177]

> *We would like to develop materials but are constrained by concerns about time commitment required to produce good quality materials.* [49]

Institutional support and the need for clear institutional decisions regarding the systems to be used were cited as reasons for not developing CAL materials [47, 49].

The nature of the course, the approach taken to delivery and pedagogic issues also appeared to affect the decision to develop CAL. There was little indication that CAL materials would replace in their entirety existing delivery mechanisms. Rather the resources developed would complement learning and teaching [121, 148], aid revision [121, 200, 208] and make distance learning more interactive [66].

> *The [computer-aided] learning material allows the students to build upon taught work in lectures, to prepare and self-assess seminars and provide additional learning foundations. It also provides the staff with a different method of delivery that is not as intensive but offers the same delivery benefits as taught modules.* [61]

Piecemeal development was proposed, as and when useful applications were identified [105]. Indeed, one respondent was seeking university approval for the replacement of elements of a foundation course with CAL [91].

In addition to offering a more flexible means of delivering material [116, 190], CAL was believed to avoid repetition, allowing students to learn factual information in their own time and was again, in this context, seen to be efficient [197].

> *The information is available as a resource rather than "precious" knowledge.* [45]

The potential of CAL to provide interactive case studies [32], enhance the teaching of computer skills [41, 100, 127, 145] and offer prompt feedback [32] were also influential in developing further this mode of delivery.

> *More student control of subject matter, level and pace.* [97]

Yet for some, initiatives of this nature were experimental [16, 57] and comparisons with other delivery modes had still to be undertaken [108].

Opposition to the use of CAL on pedagogic grounds seemed to be intrinsically linked to a reluctance to adopt distance learning, rather than any particular delivery technique.

> *The focus at [anon] is on studio design teaching, at a one-to-one student/staff level. Students are taught to use CAD but this course is concerned with face-to-face teaching, not distance learning.* [9]

This view was shared by other respondents [44, 139] who considered there to be no substitute for face-to-face contact with students either in one-to-one tutorials or small group seminars [102] and that it was this aspect of the course that students valued. Courses that were for example design-based [139], complex [125], or dealt with management development [178] were also deemed unsuitable for CAL.

> *Not the pedagogic approach required for collaborative, interdisciplinary learning.* [165]

> *Contradicts much valued interactive and dynamic learning and discovery.* [198]

CAL was perceived to be both inappropriate to course aims and too difficult to develop for challenging material [195].

> *Most computer-based learning is inappropriate for postgraduate level.* [192]

3.7.10 Factors influencing the decision to develop distance learning

Bates (1995) suggests that decision-making regarding the use of technology in distance learning should be based on an ACTIONS methodology (refer to Section 1.4). Respondents responsible for distance learning provision were requested to rank each factor in order of importance (1 for least importance, 6 for most important).

The question was repeated for course leaders currently having no such provision. The "High" (SPSS) method was used to assign ranks to tied values and a summary of each factor in a clustered box plot was produced in SPSS (Figure 3.13). Clusters were defined in accordance with the course team's future course development plans i.e. whether or not they intended to develop distance learning materials for the course prior to October 2002 (Q18(a)).

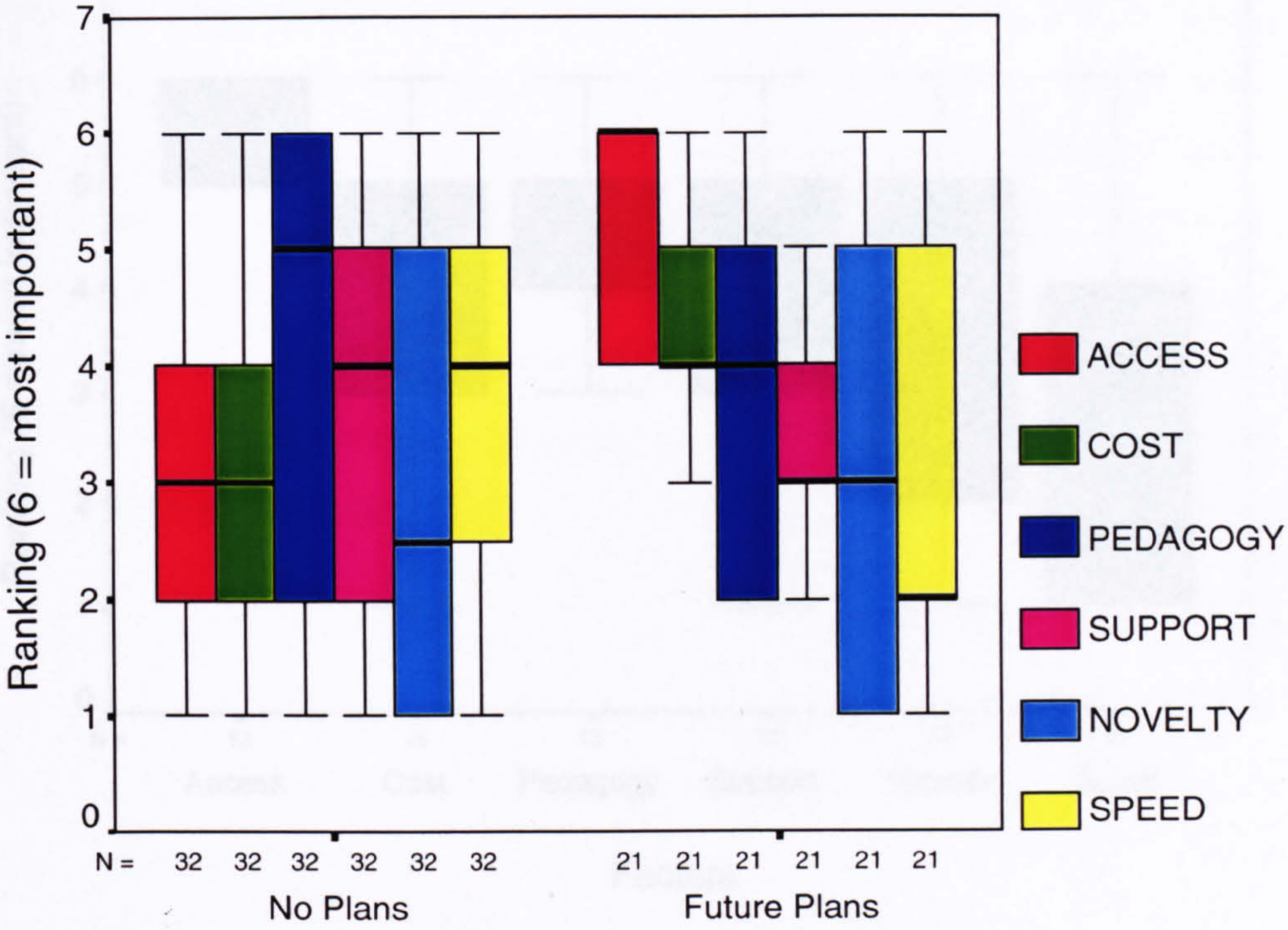


Figure 3.13 Factors influencing the proposed development of distance learning courses

The data reveals that course leaders considering the future development of distance learning materials tend to place more importance on the need for student access than those course leaders who had no plans to introduce distance learning material. Conversely course leaders who have no plans to develop distance learning attached more importance to pedagogical issues.

Respondents currently delivering distance learning courses had also prioritised student access (refer to Figure 3.14). However, given the small sample size, this must necessarily remain a tentative observation, which again demands further investigation.

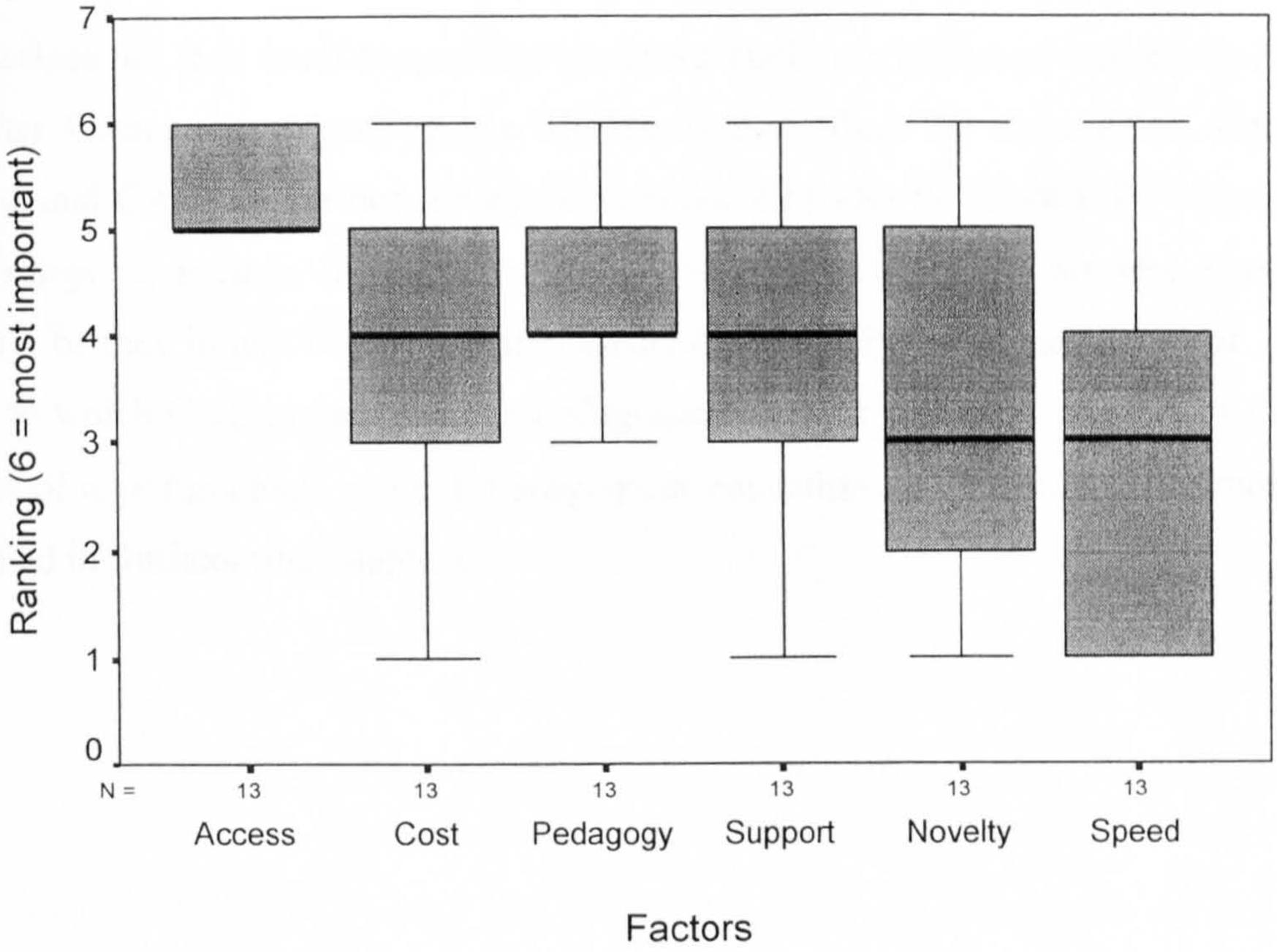


Figure 3.14 Factors that influenced the development of distance learning provision

3.8 Summary

The questionnaire return rate is considered to be satisfactory for a postal survey and has succeeded in producing rich responses that merit further analysis in SPSS TextSmart. The analysis indicates that distance learning is an anathema to many academics responsible for the delivery of postgraduate courses in the built environment. Development costs and on-going maintenance of the academic programme, administration and institutional support together with the lack of contact common to this form of delivery contribute to a relative dearth of distance learning provision.

This latter concern is directly linked to pedagogic issues such as group working, tutor feedback, student dialogue, the appropriateness of the subject matter, student motivation and the overarching sense of a "sterile" learning environment. The view that people learn more information, more quickly from computer-aided resources than traditional delivery (Tucker, 1997; Bagui, 1998) is not supported by these findings.

Unfortunately, due to the limited use of distance learning and CAL, the data in this sample does not lend itself to quantitative interpretation of observed trends. In order to gather further data regarding specific issues that affect the delivery of distance learning and CAL two further surveys are conducted (refer to Chapter 5). However, the findings reported in this chapter, are relevant to all forms of distance learning delivery, be they in text-based, multiple media or interactive multimedia format. The extent to which CAL can address the pedagogic concerns voiced by academics in the context of a postgraduate project management education and training programme is examined in forthcoming chapters.

Chapter 4

A learning strategy for the design of instructional computer-aided learning materials

4.1 Introduction

Concern that educators can become fascinated with technology and lose sight of the key educational goal i.e. to stimulate cognitive development, is perceived to be a constant threat (Underwood and Underwood, 1990; Ford and Ford, 1992; Dearing, 1997). As technological advances offer new learning opportunities, there has to be recourse to educational theory to guide design (Wild and Quinn, 1998). Chaloupka and Koppi (1998) agree with this assertion and express concern that the widespread application of technology in the educational sector is developing at a quicker pace than underpinning pedagogical strategies. It is understandable, they argue, that academics should consider reworking existing learning materials into "new" multimedia format, in an attempt to mitigate the effects of current resource constraints and enhance the quality of these materials. However, to do so without having recourse to the pedagogic issues associated with this medium may result in the creation of a learning environment that is the antithesis of the interactive multimedia experience envisaged. It is a view supported by Littlejohn *et al* (1999) who reiterate that pedagogical design must precede the development of technical capabilities. Attempting to learn material, Mayes and Fowler (1999) observe, for which no previously established conceptual framework exists is a meaningless task.

Benyon *et al* (1997) voice similar concerns. They identify a six-stage model that recognises both the importance of clearly specifying the aims and objectives of the learning resource and selecting a pedagogic approach that is consistent with the delivery technology and authoring tools available.

Earlier chapters in this thesis explored the wider contextual issues associated with the discipline of project management. Therefore, the emphasis here, is on the module specific outcomes and competencies i.e. "courseware specification", and the pedagogic approach to be adopted in the development of a new distributed interactive multimedia educational project management resource ($DIME^{PM}$). Following a brief resumé of learning theory, a review is undertaken of alternative pedagogical paradigms in a CAL context. Acknowledging also that the characteristics of the learner are an important consideration in the design of a management course (Robotham, 1995), an instructional design for $DIME^{PM}$ is proposed, that takes cognisance of several pedagogic design methodologies. As Conole and Oliver (1998) state "what is needed is a convincing and practical pedagogically driven (as opposed to technologically driven) methodology".

4.2 Learning theory

The classical works of Pavlov, Skinner and Thorndike, form the basis of behaviourism and learning theory. Behavioural theories focus on the ways in which pleasurable or painful consequences of behaviour change an individuals' behaviour over time and how individuals model their behaviour on that of others (Slavin, 1997). The principles of classical and operant conditioning, reinforcement scheduling, punishment, shaping, discrimination and generalisation expounded by these early psychologists are still relevant today and impact upon specific instructional methodologies. However, behaviourism came under increasing criticism, in part due to the mechanistic models used in its early developmental period (Bandura, 1977). Bandura, while accepting many of these principles, recognised the progress made in our understanding of psychological processes and placed emphasis on vicarious learning i.e. learning from observing the consequences of others' behaviour, and self-regulatory processes. Self-regulatory learning is a concept based upon the belief that people are able to exercise some measure of control over their own behaviour. A comprehensive theory of behaviour, Bandura states, must explain how patterns of behaviour are acquired and how their expression is continuously regulated by the interplay of self-generated and external sources. As such, his work helped cross the divide between behavioural and cognitive learning.

Cognitive learning theories emphasise the unobservable mental processes that people use to learn and remember new information (Slavin, 1997). Basic concepts such as short-term and long-term memory and an understanding of the factors that influence retention, recall and the processing of information are considered to be essential in the design of effective learning programmes.

Learning is viewed as a by-product of comprehension and it is through the acquisition of techniques for comprehending, that cognitive development occurs (Mayes, 1992). Mayes outlines several cognitive tools i.e. techniques enhancing the learner's analytical processes, which seek to facilitate learning. These approaches focus upon problem solving, mental modelling and experimentation. Indeed the computer itself, he states, may be employed as a "cognitive tool", allowing learners, in an interactive multimedia environment, "to create and modify their own schemas and enter into a real or virtual dialogue with others" (Wild and Clark, 1998).

The origin of constructivist theory is found in the work of Piaget (1985) who suggests that new information interacts with prior knowledge through a process of assimilation and accommodation. Baumgartner (1993) concurs, placing emphasis on the dialogue between the learner and the environment (or social context) in which learning takes place.

> *Learning as representation process depicts the (objective-behaviourist) learner as an empty sheet of paper that needs to be filled. Learning as construction process depicts the (subjective-constructivist) learner as a candle that can be lit.* (Baumgartner, 1993)

Tait (1997) identifies some common principles upon which constructivism is based:

- learning involves the active construction of a personal conceptual knowledge base by the learner;
- learning is reflective, building on and developing the learner's existing knowledge;
- learning benefits from multiple views of a subject area; and
- learning is facilitated by authentic activity relevant to the situation in which it will be applied.

Constructivism is informed by a wide variety of theories that model student learning. The unifying concept is that understanding is constructed by the learner and that there is, of necessity, an interpretation of the concept in the mind of the learner rather than the gradual acquisition of the concept (Wild and Clark, 1998). Twining (1999), who holds similar constructivist views of learning, suggests that new technologies can be used to support this philosophical stance and enhance the student learning experience.

4.3 Competing paradigms in computer-aided learning

Paterson and Rosbottom (1995) link behaviourist and cognitivist learning theories in a continuum, upon which it is possible to position learning strategies, outcomes and computer-mediated learning (refer to Table 4.1).

	Behaviourist		Cognitivist
	Theories of Education		
	Classification by amount of learner freedom		
Computer-mediated Learning	Instructional approach **Computer-aided instruction**		Learning approach **Computer-aided learning**
Learning Strategies	Drill and practice Limited problem solving Routine testing	Case studies Experiment simulations Business and strategy games	All open styles of learning Rule-based problem solving Exploration of information Creative composition
Learning outcomes and environments	Single learning outcome Intelligent tutoring systems	Microworlds[1]	Multiple learning outcomes Cognitive tools
Software	Self-contained closed environments e.g. Guide	Self-contained but allowing limited links to range of external sources e.g. Toolbook, Authorware	Completely open environment supporting almost unrestricted links e.g. WebCT, Blackboard

Table 4.1 Educational Theory Continuum (adapted from Paterson & Rosbottom, 1995)

[1] Papert's (1980) "micro-world" is an environment in which students test ideas and "learn by doing".

In a historical analysis of computer-mediated learning, Koschmann (1996) argues that theories of learning have "driven" paradigmatic shifts in instructional technology. Unlike Paterson and Rosbottom (1995), who distinguish between computer-aided instruction (CAI) i.e. where the student is the recipient of knowledge, and computer-aided learning (CAL) i.e. where the student is actively involved and is in control of the learning process, Koschmann offers a different classification. He favours a classification which recognises the individual characteristics of CAI, Intelligent Tutoring Systems (ITS), Logo (a programming language designed by Wally Feurzeig) and an "emerging" Computer Supported Collaborative Learning (CSCL) paradigm. These four paradigms are closely aligned to behaviourist, cognitivist, constructivist and "socially oriented" theories of learning[2]. Indeed each paradigm, he argues, represents a different philosophy about the use of technology in education.

Paquette (1997) presents six paradigms which offer a "techno-pedagogical" perspective : the "enriched classroom" using technologies within a traditional setting; the "virtual classroom" providing video conferencing facilities to support distance learners and teachers; the "teaching media" allowing access to prefabricated multimedia courses; "information highway training" utilising on-line workstations to gather research material; the "communication network" offering synchronous and asynchronous communication in addition to media support; and performance support systems (EPSS) providing integrated training in the workplace. Recognising the current popularity of the first two paradigms she questions whether they are sustainable and indeed desirable as the HE sector seeks to address the needs of the lifelong learner.

The concept of a continuum receives further support from Slavin (1997), who observes that the boundary between behavioural and cognitive learning theory has become increasingly indistinct in recent years, as each school of thought incorporates the findings of the others. An example of this overlap is provided by Mayes (1992) in a review of cognitive tools for learning.

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[2] Koschmann (1996) concedes that there probably exist additional paradigms that are not discussed in his paper

Instructional methods which give declarative knowledge about problem solving strategies (i.e. proceduralisation) followed by production rules and the construction of comprehensive frameworks (i.e. composition) are compared to the behaviourist approach of shaping. Mayes (1992) suggests that both approaches rely on problem solving to achieve the necessary learning outcomes.

However, Mayes and Fowler (1999) argue that instructional and constructivist pedagogical approaches to learning do impact upon software usability. Both approaches assume straightforward 'operational' usability i.e. allowing the functionality of the software to be discovered and used, but they diverge on the question of learning. While an instructional approach, it is suggested, relies on the impact of content presentation, constructivist delivery focuses on learner support mechanisms during the performance of active problem solving tasks. Mayes and Fowler (1999) suggest that CAL (or "courseware") is an inadequate term which obscures differences both in the pedagogical and technological design of educational software. They favour paradigms based on a learner-centred perspective i.e. primary, secondary and tertiary courseware.

The key characteristic of primary software is to orient the learner towards the subject matter, providing a map of the resource and the educational goals to be attained. Secondary courseware provides the learner with a set of tools that support task-based learning activity and tertiary courseware enables students to benefit from the learning experiences of their peers. Rather than viewing each of these paradigms as discrete applications, Mayes and Fowler (1999) place them within a "conceptual learning cycle" (refer to Figure 4.1), characterised by the notion of continuous development.

Conceptualization is characterised by learners "coming into contact with other people's concepts" and, in the Construction stage, by learners building and testing their knowledge by undertaking relevant activities i.e. "learning by doing". In the final stage the goal is to use conceptualizations in applied contexts and converse with tutors and peers thereby promoting reflection. Their framework, therefore, provides a practical insight into the functional requirements of different kinds of courseware.

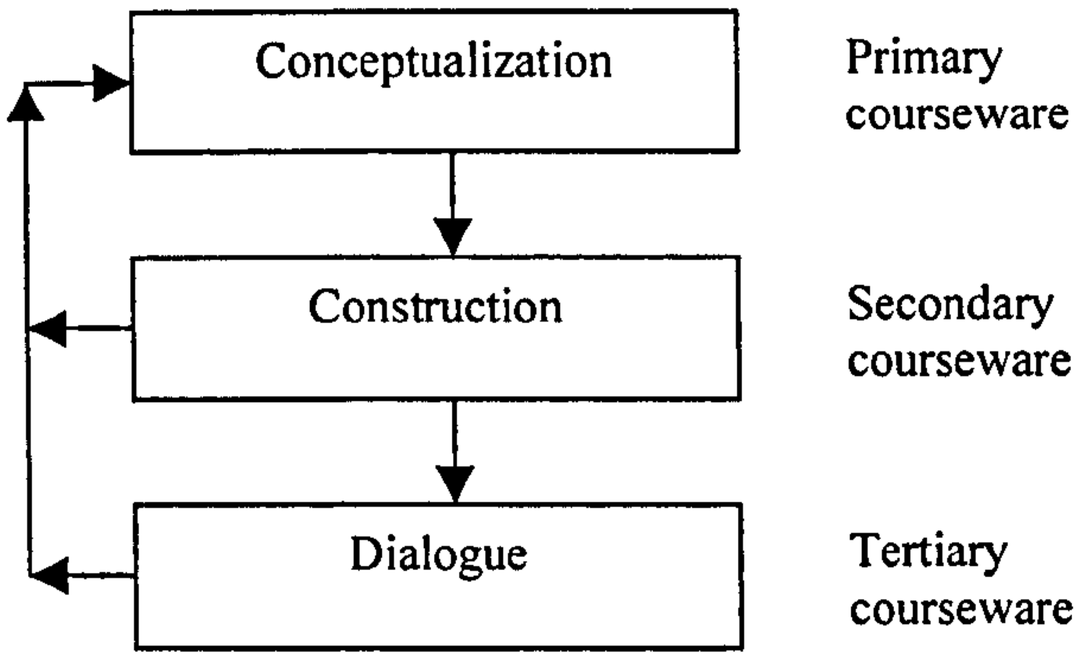

Figure 4.1 The (re)conceptualisation or learning cycle (Source: Mayes and Fowler, 1999)

Wild and Quinn (1998) also consider the polarisation of constructivism and behaviourism unhelpful in determining effective instructional design. The analogy they use to describe learning theories as a whole i.e. as a series corresponding and opposing objects, each with its own (sometimes common) attributes, is extremely useful. Their "convergent" model, which emphasises the role of active exploration on the part of the learner, and the need for guidance through a process of mediated dialogue, is one which, they believe, could be addressed through technological mediation. Hence, CAL should provide access to information resources, facilitate cognitive development, and ensure that the learner receives appropriate "scaffolded reflection".

Indeed subsequent work by Fowler and Mayes (1999) places increased emphasis on the need for dialogue, suggesting that its importance is “at least level with conceptualization as a pedagogic design principle”. Again choosing to focus on the pedagogical issues associated with dialogue they seek to classify the learning relationship in accordance with form, type, distance and context. Future research, they propose, should target those aspects of effective learning support that demand human interaction as opposed to a technological solution.

Lee and McKendree (1999) extend the concept of tertiary courseware. An experimental system, based on a web-based postgraduate course, was used to elicit focused discussions that were in turn integrated into on-line learning resources.

Founded on the premise that "vicarious learning" would enhance the student experience, their research revealed cognitive and social benefits i.e. "positive changes in attitude and discussion behaviour". In addition to the benefits gained through active involvement in discussion, they conclude that observation of peer dialogue may at times have been of greater value.

4.4 Learning-style preference

The concept of learning styles has attracted much attention since the early 1970s. Many researchers developed theoretical models that sought to explain differences in how students learn (Burns and Johnson, 1998). Arguably the most widely known models of the learning process were devised by Kolb (1984) and Honey and Mumford (1986), both of which are characterised by the concept of experiential learning. Reflection upon the experience would lead, they suggest, to the generation of abstract concepts that might then be tested. The cycle is an iterative one (refer to Section 1.4). Honey and Mumford (1986) identify four different learning style preferences i.e. Activists, Reflectors, Theorists and Pragmatists, and by means of a learning styles questionnaire (LSQ) establish the extent to which learners, oriented to a particular style, would be attracted to certain types of activity. Although the model is not without its critics (e.g. Caple and Martin, 1994; Sadler-Smith, 1996b), many commercial trainers and educators have adopted their approach in the design of learning programmes (Valley, 1997).

The relationship between individual learning styles and the efficiency and effectiveness of CAL has been the subject of much debate (Paterson and Rosbottom, 1995; Sadler-Smith, 1996a; Jones et al, 1997; Pillay *et al*, 1998). The research of Dixon and Woolhouse (1996) demonstrates that there is some relationship between the preferred learning styles and teaching approaches adopted by teachers but they also acknowledge that it is very intricate and involved. This issue is further complicated, by questioning at a more fundamental level, whether learning programmes should be tailored to suit an individual's learning style. To do so, Robotham (1995) warns, is to place the developer in danger of encouraging individuals to adopt a particular learning style in the belief that it constitutes a good style and to avoid learning situations that are alien to them.

Valley (1997) argues that there are not, as yet, sufficiently clear links between learning styles, teaching strategies and learning activities and that very little is known about the stability of learning styles. She presents two courseware design solutions, both of which seek to accommodate preferred learning styles, and concludes that attempts to match activities to these styles is neither a useful nor worthwhile activity.

Innovations in multimedia technology, however, offer new ways of developing CAL which are better suited to the varying cognitive styles of learners. Pillay *et al* (1998) undertook a quasi-experimental study to investigate the effect of matching preferred cognitive styles to instructional format on learning outcomes. They highlight the need to consider both the format in which the information is presented (refer to Chapter 6) and how the information is processed in the design of computer-based instruction. This latter design feature is reflected largely in the structure of the instructional material. "Wholists"[3], they observe, tend to organise information in loosely defined clusters, whereas "Analytics" require clear conceptual groupings. Consequently the "Wholists" prefer to develop the "big picture" while the "Analytics" need to see how the information is broken down. They conclude that the cognitive load placed upon students can be reduced if access to information is in a format that corresponds to their learning style. It is contended, therefore, that learning strategies i.e. plans of action for the acquisition of knowledge, skills or attitude through study or experience (Sadler-Smith, 1996b), should make a conscious attempt to accommodate learning style preferences. Arguably the most pragmatic solution is to provide a variety of learning methods and allow learners to select alternative materials and media to suit their preference. Such an approach is ideally suited to "self-instructional" materials (Sadler-Smith, 1996b).

4.5 *DIME^{PM} specification*

The "Project Management" M Level module within the Built Environment Modular Scheme at Leeds Metropolitan University (refer to Section 1.5.1) was first delivered in 1994.

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[3] Riding and Cheema (1991) suggest that there are two basic dimensions of cognitive style:
a. the wholist-analytic i.e. whether an individual tends to process information in whole or in parts; and
b. the verbal-imagery i.e. whether an individual is inclined to represent information during thinking verbally or in images".

As such the module is well established within the School of the Built Environment's postgraduate curriculum and has, throughout this period, complied with the University's standard course monitoring procedures. The courseware specification used in this study, therefore, is taken directly from the Project Management module specification and comprises the following outcomes and competencies:

- Critically evaluate the procedures involved in the identification and translation of project objectives within the client briefing process;
- Assess the relative importance of key project management tools and techniques;
- Demonstrate an ability to employ interpersonal and communication skills in a professional context; and
- Devise an operational plan for a project cognisant of procurement, contractual and production arrangements and the employment of consultants.

The content supporting each delivery mode (refer to Section 1.5.3) is identical and conforms to the above learning goals.

4.6 Instructional design philosophy adopted in DIME^{PM}

Planning must "precede effective design" (Gagne, 1985). The acquisition of knowledge is a process in which new capability builds on a foundation established by previously learned capabilities (Gagne, 1985). The pedagogic design strategy adopted in the development of DIME^{PM} reflects this imperative and adopts in part the framework articulated by Fowler and Mayes (1999) in a continuum-based instructional design that is characterised by three defined stages:

- Stage 1: Conceptualisation - behaviourist principles that emphasise conditioning and shaping; students undertake a series of structured and sequenced tasks, each with its own stated objectives i.e."drill and practice";
- Stage 2: Construction - cognitivist principles that develop learners' questioning and explanatory capabilities; theoretical underpinning is contextualised by the use of case studies and summative project-based assessment tasks; and
- Stage 3: Dialogue - constructivist principles that encourage learners to reflect and personalise their knowledge base.

The "continuum" concept also reflects the instructional design adopted by Ertmer and Newby (1993) which is based on a combination of the three main theories of learning, commencing with a behaviourist approach, progressing to cognitivism and finally to constructivism as requirements for mental effort increase. Moreover, it is a strategy consistent with that advocated by Laurillard (1995), who suggests that instructional design should adhere to the following design principles:

- learners are kept aware of the goal throughout the program;
- learners are advised of what is an appropriate way to approach the task;
- learners may construct their own approach;
- access to the narrative line is readily available;
- learners construct their own analysis before being able to access the expert's; and
- expert analysis is available for learners to check against their own.

4.6.1 Stages 1 and 2

Koper (1998) states that in most projects pedagogical design is specified using rather adhoc methods which could have consequences on the quality of the educational software being employed. In an attempt to make the development process more effective and improve pedagogic design in general, a method is outlined that is not constrained by the philosophical leanings of the developer. The "pedagogic design specification method" adopts an object oriented-design methodology based on the concept of a "pedagogic scenario". Koper (1998) refers to a pedagogic scenario as a "virtual learning environment or learning rooms" in which students interact with objects. Within each scenario is a series of objects defined by their class, status and view (refer to Figure 4.2). A good design, Koper (1998) observes, must permit all these views on the same objects. Defining an object as a complete treatment of its associated topic, Tait (1997) also advocates an object-oriented hierarchical model to structure information in an internet-based learning package. Tait (1997) concludes that this pattern is consistent with a constructivist philosophy.

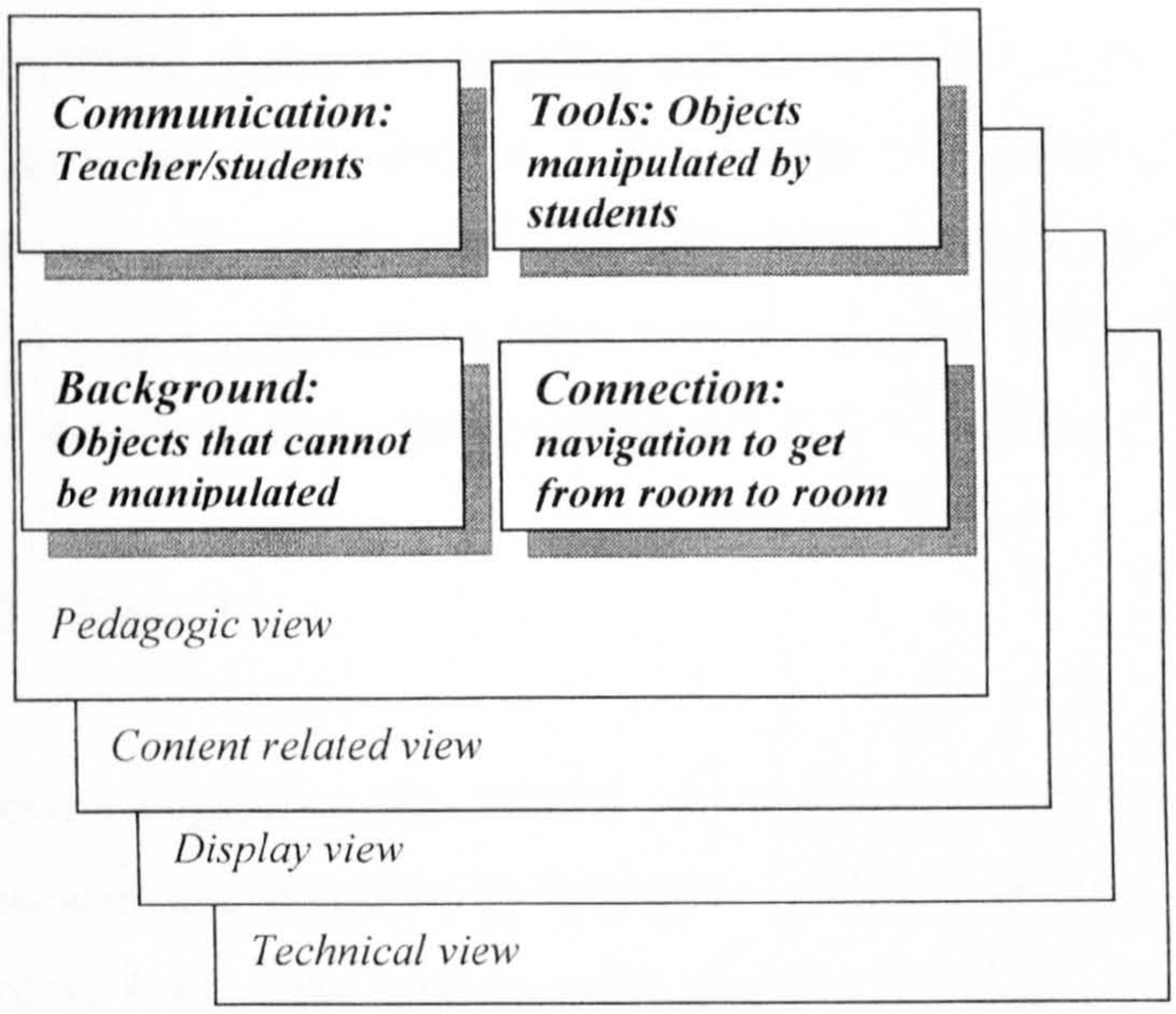

Figure 4.2 Structuring the pedagogic design (adapted from Koper, 1998)

Likewise, Conole and Oliver (1998) urge the multimedia developer to focus on "learning scenarios" rather than courses and to analyse course composition in terms of its aims and objectives. A learning scenario is defined by media type, the preparatory work required, use of media, educational interactions and the delivery constraints. Drawing on the work of three existing approaches (Mapp, 1994; Harrison, 1994; and Lewis and Merton, 1996) they provide a highly practical, pedagogically driven framework, which offers useful guidance for the developer. Practitioners work through a series of media comparison tables and delivery constraint comparison charts, identifying the appropriate method of transferring and enhancing course delivery.

Quite how students react to one media type within a learning scenario is questioned by Twining (1999). It would be naïve, he believes, to assume that students always use resources in ways that draw on their strengths. However, he does accept that changes in the balance of media affect student activity and impact upon the underlying educational model. A comparison of traditional OU and interactive multimedia courses revealed that students, enrolled on the latter, placed less emphasis on content and that the role of the tutor was perceived to be one of "facilitator" rather than "expert" tutor. Consequently, students using CAL found alternative sources of information on the Internet.

Seale (1999) agrees that learning technology offers new ways to access information but fears that CAL also promotes a lack of confidence and a low valuation of discussion. Irrespective of which of these two standpoints is favoured, Twining's (1999) conclusion that students need to acquire new technical, social and learning skills in order to make best possible use of CAL appears sound.

4.6.2 Stage 3

Concerns regarding the "limits of learning" in so-called primary and secondary courseware are identified by Grantham and Hunt (1999). Rather than promoting deep learning, CAL "can tend to push students towards a 'water boatman' approach to learning i.e. skipping over the surface instead of looking more closely at what might lie underneath" (Grantham and Hunt, 1999). Lack of context, a tendency for software to assume an austere approach and an inability to provide links with prior learning (an important factor in successful primary courseware) are also perceived to be common problems associated with multimedia design. Benyon *et al* (1997) are unconvinced that pedagogical benefit is to be gained from merely hypertextualising an existing course. They believe that the "real added value" of Internet delivery arises from enhanced communication and the multimedia aspects of technology. It is arguably the lack of dialogue and feedback, combined with the "real drawback" that developers of software are in effect determining the questions for students, that prompts Grantham and Hunt (1999) to explore whether a web interface can address these weaknesses. Benigno and Trentin (2000) refer to web-based virtual environments as "third-generation" distance learning, which they state, fosters communication and collaborative learning.

It is helpful to return to Laurillard's (1993) view of the teaching and learning process and the design features that characterise a "conversational framework":

Discussion: break down the ultimate goal into interim goals for investigation;
provide advice on how to approach the investigation;
provide an expert's commentary on the goal and its relation to relevant data; and
provide the means for learners to articulate their own commentary;

Interaction: make the desired interim conclusion the goal stated at the start;
provide ways of investigating the data and recording findings;
suggest the amount of investigation appropriate to each goal; and
inspect and comment on the amount done;

Adaptation: make the expert's analysis available only after student's has been done; and
allow editing of learner's own descriptions;

Reflection: encourage appropriate processing of the information found; and
use higher level goals to integrate work done at lower levels.

Web-based delivery does offer an opportunity to satisfy these features but it also raises a series of pedagogical and technical problems. Grantham and Hunt (1999) found that there was a tendency for on-line discussions to degenerate into a general chat facility, for students to become frustrated and waste time visiting irrelevant web sites and for conferencing to be used for communication that may be better handled face to face. They conclude that an electronic learning environment can resolve some of these pedagogical issues and provide a learning environment in which the student can make more sense of the subject. But there remains a need for some "mix" of face-to-face learning and electronic learning. Bianchetti's (2000) research into group problem solving and decision-making raises similar issues. Careful design of computer-mediated communication (CMC) activities is believed to be essential.

Stefanov *et al* (1998) promotes dialogue by means of a virtual learning environment (VLE). The distance learning course they developed ('Business on the Internet') combined resource-based learning with individual learning and adopted a learner centred instructional strategy. Although the curriculum adopted a modular design, as in this research study, students were encouraged to discover and construct their own knowledge. The most important characteristic of a VLE, they state, is the availability of virtual places, where students can work together as if they were face to face. As such it is seen as complementing traditional education with a "virtual component" (Stefanov *et al*, 1998).

Recognising that a different communication medium may result in learners opting out of spontaneous interaction with tutors and peers, Musselbrook *et al* (2000) undertook research to identify effective communicative practices for different conferencing technologies. They conclude that communication should not be treated as a separate entity. Moreover the development of communication skills will happen in response to a specific task. The learner needs to be aware 'why' such communication is important and not merely how to operate the technology if a paradigm shift is to be achieved.

Notwithstanding the communication facilities offered by the Internet and the implications on "Stage 3" of the instructional design strategy, the web also provides access to information that neither educators nor their students can ignore (Jefferies and Hussain, 1998). Exponential growth of the information residing on the Internet provides an increasingly valuable asset for postgraduate research. Moreover, if the notion of constructivism is to be embraced, then the Internet can provide a means by which the learner can discover and construct knowledge, thereby promoting the concept of learner-centred education.

4.7 Summary

Concerns that the "bells and whistles" associated with multimedia educational programs might distract developers from a full consideration of the underlying pedagogic issues have been voiced by many authors (Lawless and Kulilowich, 1998). Accordingly a coherent learning strategy must recognise the importance of instructional design (Benyon *et al*, 1997).

It is suggested that behaviourist, cognitive and constructivist theories need not necessarily be viewed as competing paradigms but that each approach could be usefully integrated within a single CAL application. The work of Mayes and Fowler (1999) is helpful in developing further the concept of a continuum, emphasising the progression from conceptualisation to construction and reinforcing the need to encourage reflection through dialogue. Such an approach impacts upon the selection of courseware. The inherent limitations of primary and secondary courseware, it is posited, might be alleviated by the use of a complementary VLE.

In order to align the learning resource with students' preferred learner styles, the pragmatic solution advocated by Valley (1997) is persuasive. DIME^{PM} seeks to accommodate potential learning preferences by presenting users with a range of activities and a comprehensive set of navigation tools, similar to those used by Wild and Quinn (1998). A discussion of design imperatives for instructional multimedia programs, in the context of DIME^{PM}, follows a review of current practice in computer-aided learning.

Chapter 5

Current practice in computer-aided learning

5.1 Introduction

In order to gain an insight into current practice in CAL, the survey referred to in Chapter 3, incorporated a section devoted entirely to this form of delivery. However, the survey revealed relatively little evidence of CAL in the delivery of distance learning in built environment. In total only eleven of the postgraduate courses in the sample used CAL to assist in the delivery of distance learning resources. Two further surveys were undertaken - a postal survey of TLTP co-ordinators and an on-line survey distributed to academics responsible for the delivery of international built environment provision. The collective results, reported in this chapter, are used to inform the design of a distributed interactive multimedia software application.

5.2 CAL questionnaire

It was noted previously that little evidence of CAL activity in the postgraduate built environment sector had been revealed by the UK survey referred to in Chapter 3. Therefore the survey was broadened so as to include TLTP Phases 2 and 3 project co-ordinators. In total 84 TLTP co-ordinators were identified from the TLTP website (http://www.ncteam.ac.uk/new_version/projects/tltp), each being forwarded an abridged version of the original questionnaire. Eleven responses to the aforementioned "built environment survey" were complemented by 37 (44%) responses, returned from the intial tranche of mail questionnaires, and an additional 17 (20%) responses received after the distribution of one follow-up letter.

The data collected in this survey (refer to Appendix B) therefore draws from a wide range of disciplines, such as chemistry, health sciences and engineering, and various types of educational provision i.e. undergraduate, postgraduate, Further Education (FE), professional development activities and corporate training (refer to Figure 5.1).

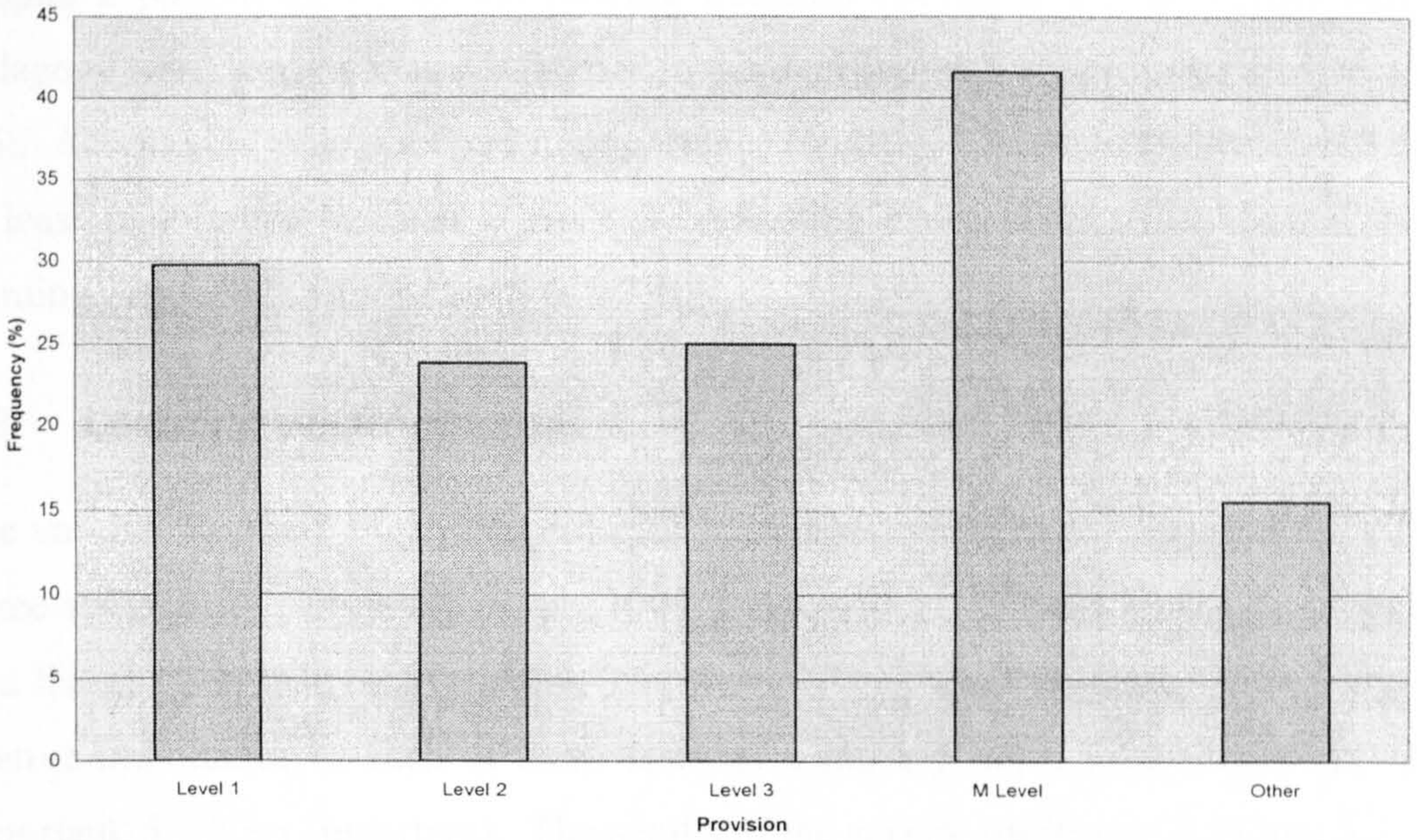

Figure 5.1 Respondent's experience in CAL delivery (May 2000)

Factors that have influenced respondents' decisions to develop CAL resources are again based on ranking an adapted version of Bates's (1995) decision-making methodology i.e. student access, unit cost per student, pedagogic needs of students, organisational support, novelty of delivery mode and speed of implementation (refer to Figure 5.2)

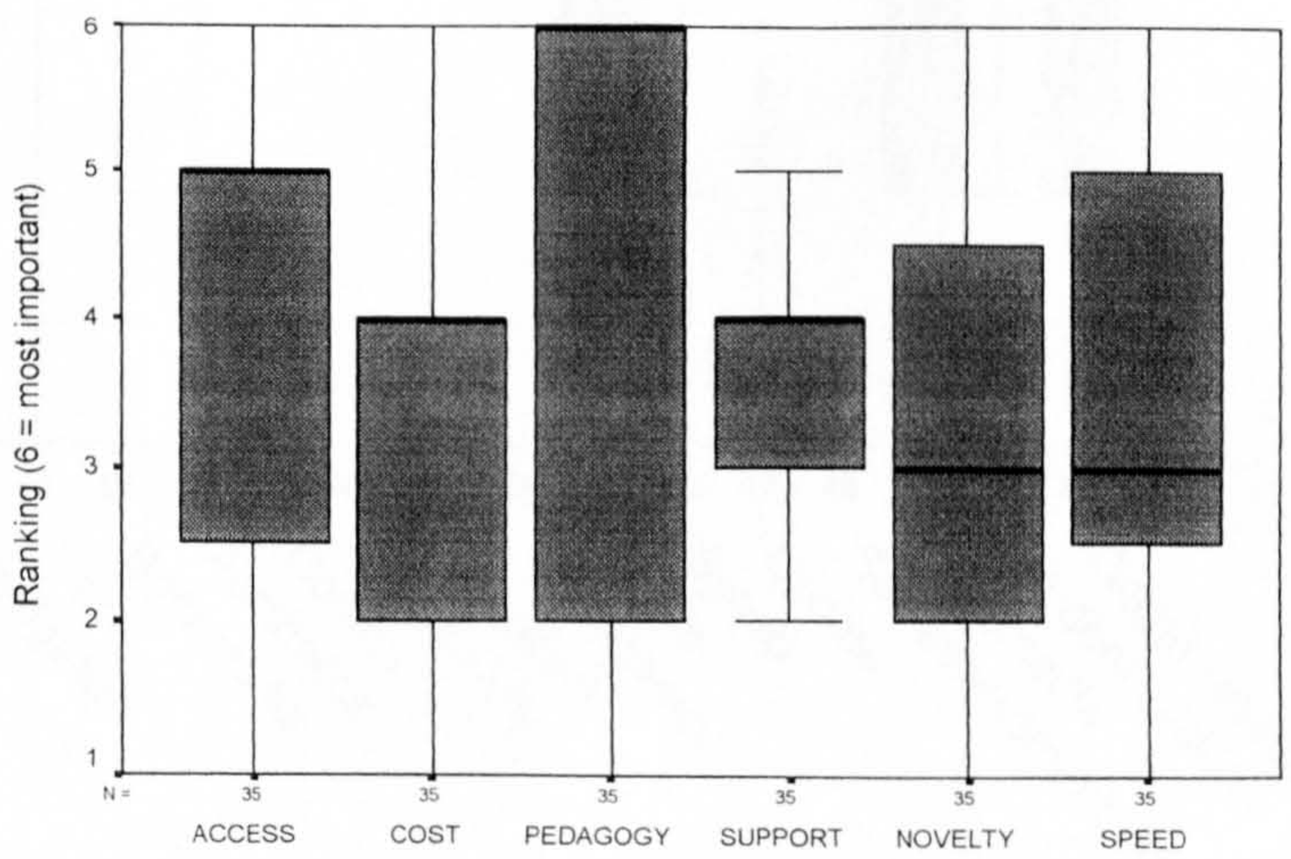

Figure 5.2 Factors that influenced the decision to develop CAL (produced in SPSS v10)[1]

[1] Box-plot shows the frequency distribution, displaying the median and quartiles

Despite a poor response to the ranking question (54%), as in the earlier survey, pedagogy was clearly a major influence in the decision-making process (median score = 6). Access was ranked second in importance (median = 5). Novelty and speed were of least importance (median score = 3) reflecting earlier views regarding distance learning in general (refer to Section 3.7.10)

5.3 Learning environments

The various facets of a technology-based learning environment, identified by a Task Force at Coventry University in July 1998, were used as the basis for the development of a list of CAL features (Question 13). Respondents were requested to indicate the relative importance of each of these features using a 5 point Likert scale (1 = Not important, 5 = Very important). The results of the survey are shown in Figure 5.3.

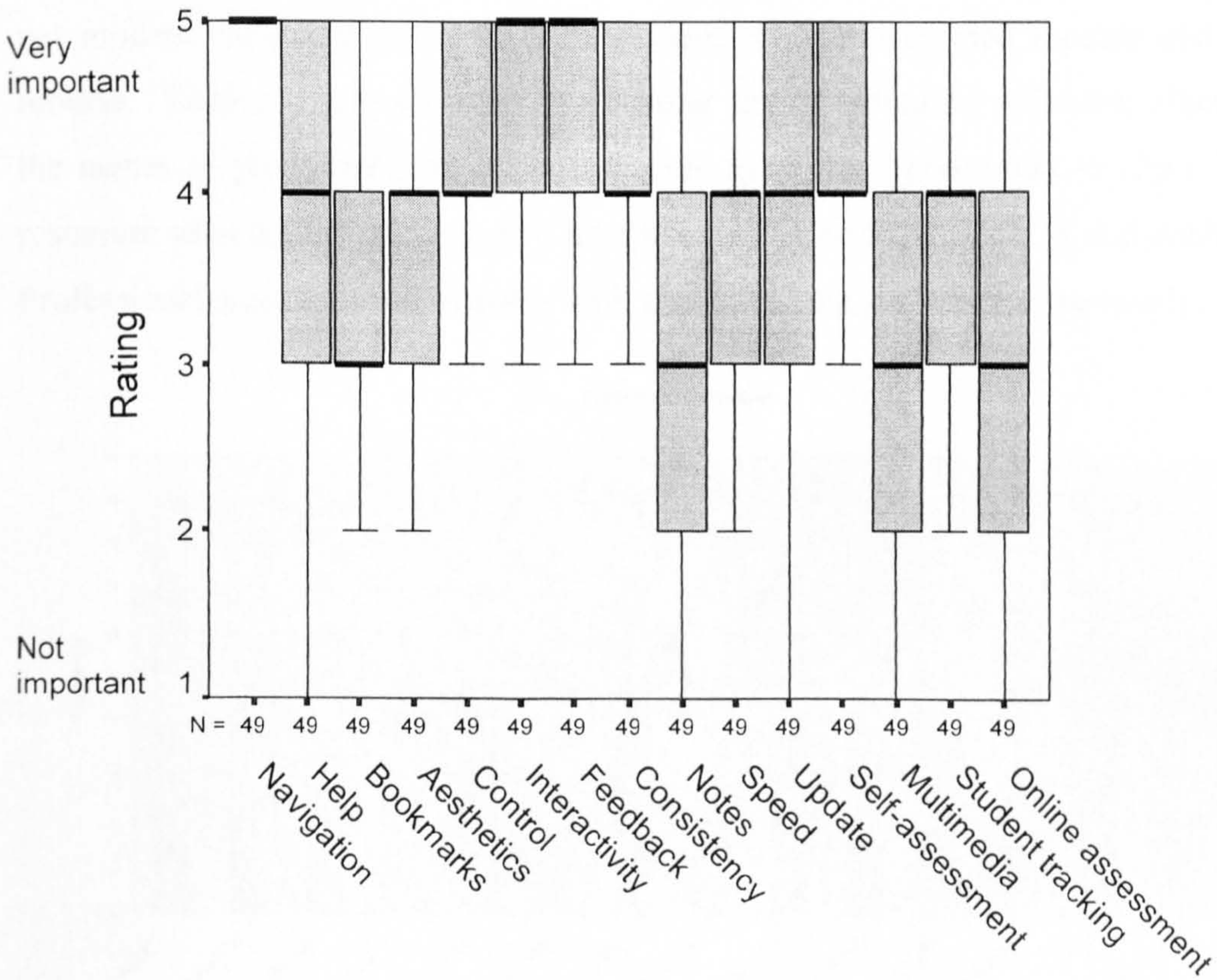

Figure 5.3 Relative importance of design features in a CAL environment

Many of the features identified by the Task Force were considered to be important. Navigation, feedback and interactivity were perceived to be very important features (median score = 5) in a CAL environment, with help facilities, aesthetics, student control, consistency, speed, direct updating by staff and student tracking each receiving a median score of 4. The remainder i.e. bookmarks, student notes, multimedia and on-line assessments received a median score of 3. Furthermore, 81% (35 No.) of respondents currently developing CAL resources, provided students with the facility to print a paper copy of the learning material (Question 8). The results indicate that distributed interactive multimedia, an in particular DIME^{PM}, should embrace all these features.

5.4 Authoring software

Liu and Hsu (1999) provide a summary of authoring methods i.e. flowchart models, net models, time-line models, script models, structure-oriented models and hybrid models. Respondents were offered a similar list of authoring software, albeit using the names of proprietary products, and were given the opportunity to identify other resources used for the creation of CAL (refer to Figure 5.4). WebCT and Authorware Professional were the most popular VLE and authoring packages respectively.

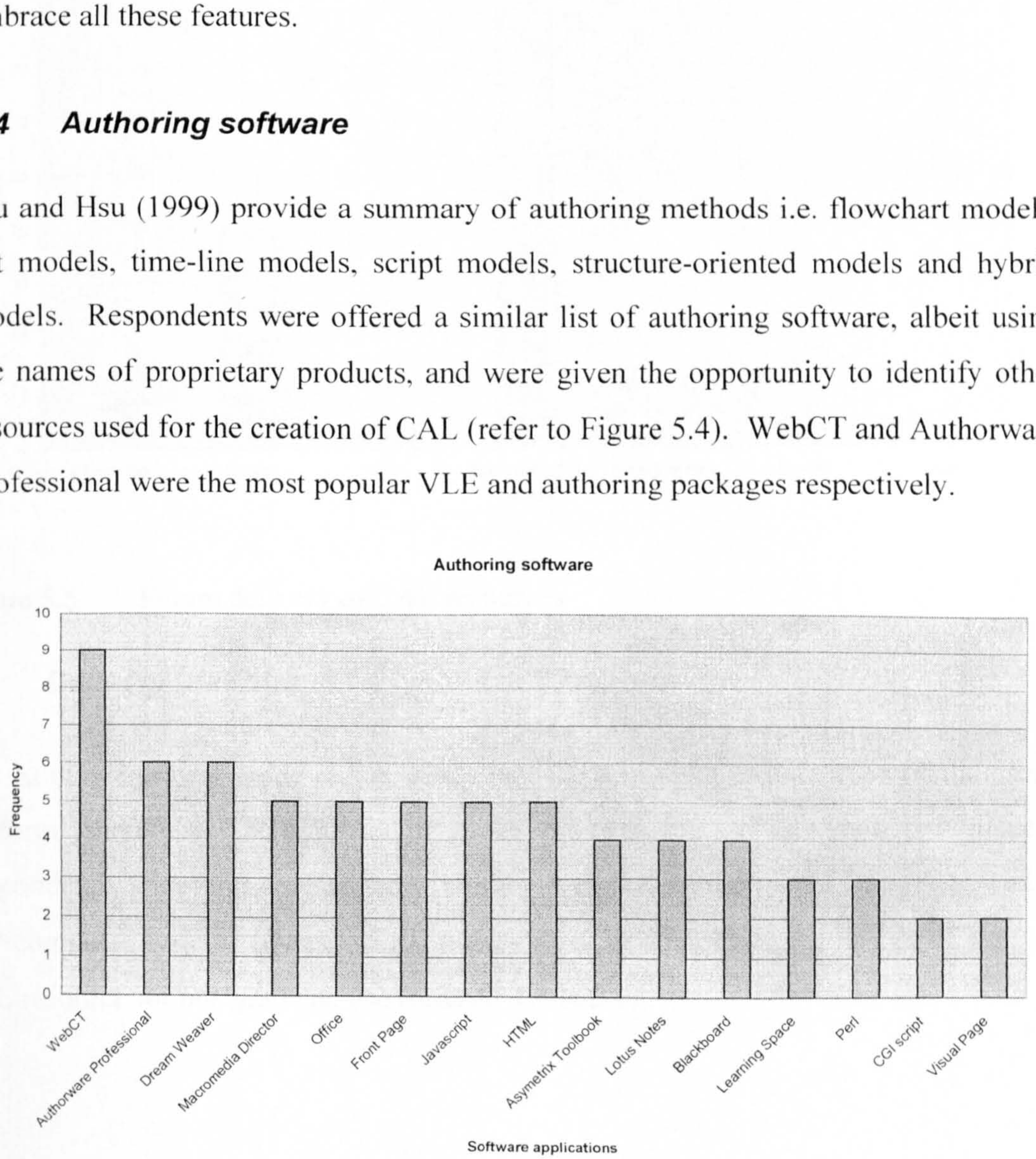

Figure 5.4 Authoring software being used in the development of CAL resources

5.5 CAL delivery

Respondents were asked to identify the preferred delivery medium for future CAL resources (Question 7). Clearly, the most popular mechanism was delivery via the World Wide Web (42 No.), followed by CD-ROM (20 No.). The use of 3.5 inch disks, DVD, interactive video, intranet and email was limited, each receiving a score less than five (refer to Figure 5.5).

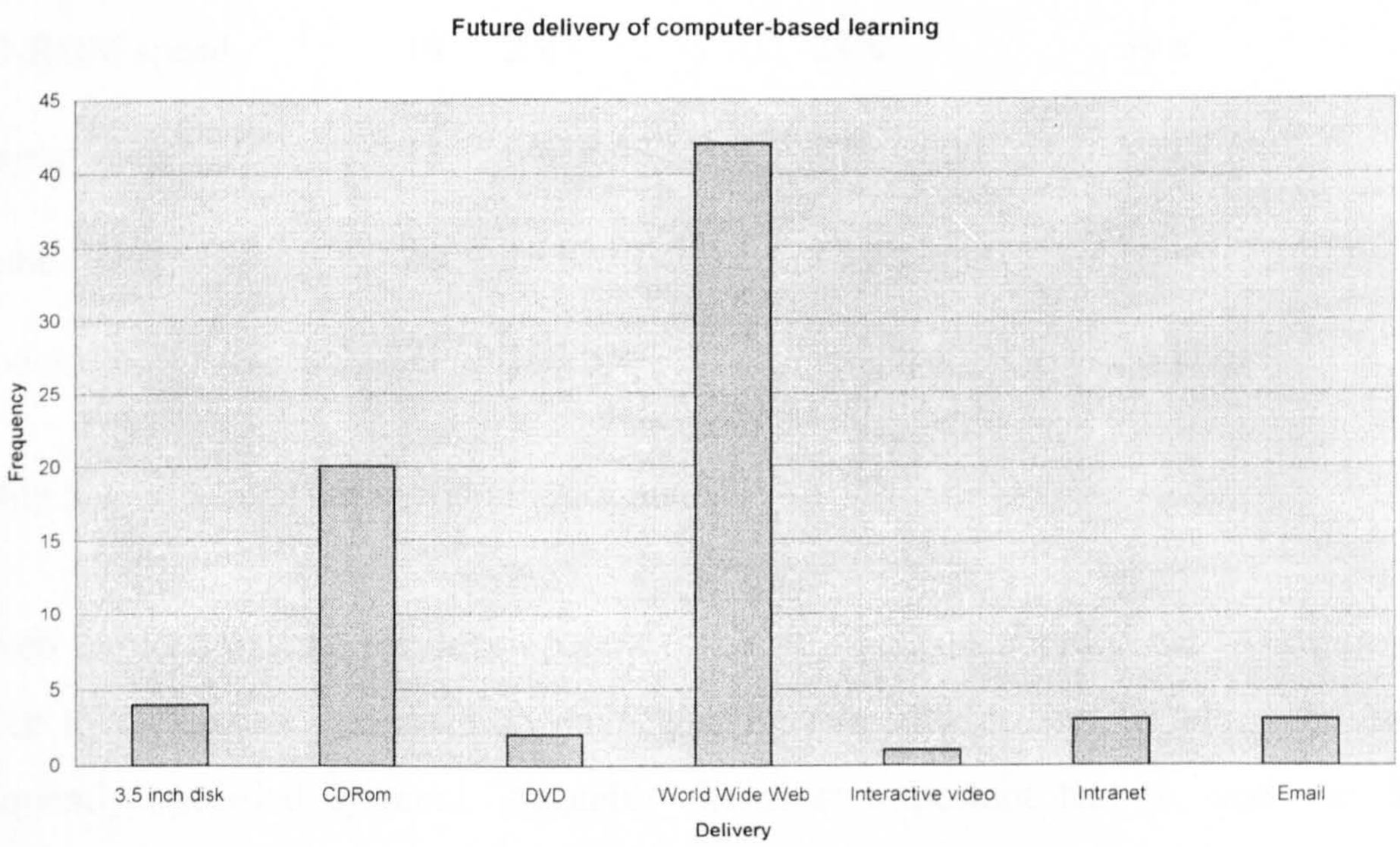

Figure 5.5 Future delivery of CAL resources

5.6 Delivery platform

The Authorware user guide recommends that the minimum specification of the user platform should be determined prior to development of an authored piece. Respondents, therefore, were asked what they regarded would be the "minimum end-user computer system" (Question 10) if they were to commence the design of a new CAL resource for postgraduate use (refer to Table 5.1).

System requirements	*n*	Minimum	Mode	Maximum
Operating system	25	N/A	Windows 95	Windows 2000
Processor	23	Pentium 133	Pentium II	Pentium III
RAM	23	8 Mb	64 Mb	128 Mb
Hard disk space	20	1 Gb	1 Gb	10 Gb
CD-ROM speed	19	2 x	24 x	34 x
Display area	18	640 x 480	800 x 600	800 x 600
Audio	20	16 bit	16 bit	16 bit
Modem	21	28 kbps	56 kbps	56 kbps

Table 5.1 End-user system requirements

Given the lead-in time for development of DIME^{PM} it was decided not to design the piece to the lowest specification envisaged by respondents, but to adopt the most frequently specified system. Arguably the most important feature, and one that affected all display screens in DIME^{PM}, was the display area. Accordingly, a 800 x 600 display was chosen for the educational program.

5.7 Learner benefits

Identical statements to those in Section 3.7.4 (Tucker, 1997) were used in identifying the learner benefits of CAL. The findings (refer to Table 5.2) are similar to those discussed in Chapter 3, in that students were perceived to gain from studying at their own pace (i.e. statement i) and were able to use the resource for revision (i.e. statement g) and for future reference (i.e. statement f). However, the benefits relative to part-time delivery (i.e. statements b, c, and d) were less clear, with a high proportion of respondents neither agreeing or disagreeing with the statements or indicating they "don't know".

Learner benefits of CBL		*n*	1	2	3	4	5	Don't Know	Median	Mode
a. Consistent message	*no*	13	8%	8%	15%	31%	39%	0%	4.0	5.0
	chl	44	5%	7%	32%	25%	20%	11%	3.5	3.0
b. Learn more[1]	*no*	13	0%	8%	15%	31%	0%	46%	4.0	4.0
	chl	40	3%	8%	23%	14%	5%	47%	3.0	3.0
c. Learn more quickly[1]	*no*	13	0%	8%	31%	8%	0%	53%	3.0	3.0
	chl	40	5%	10%	27%	13%	3%	42%	3.0	3.0
d. Knowledge retention is greater[1]	*no*	13	8%	0%	23%	31%	0%	38%	3.5	4.0
	chl	39	3%	3%	21%	17%	5%	51%	3.0	3.0
e. Study at a time that suits	*no*	13	0%	0%	0%	39%	61%	0%	5.0	5.0
	chl	45	2%	2%	0%	24%	64%	8%	5.0	5.0
f. Use as reference material	*no*	13	0%	23%	15%	15%	39%	8%	4.0	5.0
	chl	43	0%	5%	5%	26%	58%	6%	5.0	5.0
g. Use for revision	*no*	13	8%	8%	15%	30%	39%	0%	4.0	5.0
	chl	43	0%	2%	14%	23%	52%	9%	5.0	5.0
h. Learn by discovery	*no*	13	8%	8%	39%	15%	30%	0%	3.0	3.0
	chl	43	0%	2%	12%	33%	37%	16%	4.0	5.0
i. Learn at own pace	*no*	13	0%	8%	8%	45%	39%	0%	4.0	4.0
	chl	44	5%	0%	2%	30%	57%	8%	5.0	5.0
j. Make mistakes in private	*no*	13	8%	8%	15%	15%	54%	0%	5.0	5.0
	chl	44	5%	5%	16%	36%	31%	7%	4.0	4.0
k. Study what they don't already know	*no*	13	31%	8%	15%	23%	8%	15%	3.0	1.0
	chl	42	24%	12%	21%	19%	7%	17%	3.0	1.0
l. No need to travel to institution	*no*	13	0%	8%	39%	45%	0%	8%	3.0	4.0
	chl	45	2%	11%	13%	36%	29%	9%	4.0	4.0

no: respondent not currently developing CBL.

chl: respondent developing CBL

1: distance learning relative to part-time delivery mode

Table 5.2 Learner benefits of CAL

Seventy percent of respondents (30 No.) currently developing CAL resources rated the statement "students can learn by discovery" (i.e. statement h) at either 4 or 5 on the Likert scale. Surprisingly this group of respondents did not perceive the benefits of "consistency of message" (i.e. statement a) as highly as those not currently involved in such development. However, care must once again be taken in interpreting this data due to the small sample size. Further statistical analysis is inappropriate.

5.8 Problems associated with CAL

Problems in the development and delivery of CAL (Question 12a) have been experienced by 67% (39 No.) of the respondents who completed the final section of the questionnaire. One of the principal concerns of respondents was access [1, 61], due to poor technical support [16, 78], infrastructure within organisations [43, 69, 75] or difficulties experienced gaining access into the university system from off-campus [23, *115*][2].

> *Access problems for PG [postgraduate] students because of over-zealous university server security systems.* [78]

Problems were experienced getting systems to work reliably when providing secure access [*82*] such as incompatibility between chat facilities and firewalls [23]. Conflicts between CAL resources and existing network software were reported [14, 26, 44, 84]. Cross platform compatibility also led to problems [*75*]. For example, the way materials appeared on different systems [3].

Respondents suggested that a change of culture was needed from both a staff and student perspective [13]. The former was perceived to be due partly to a lack of technical ability [13, 47, *82*], partly to the "shock" of working with students other than face-to-face on a fixed timetable [*82*] and partly the result of inadequate institutional strategies [13, 46]. Such sentiments were referred to as a staff "hearts and minds" issue [26] with staff resistance being experienced [10].

> *The usual antagonism toward change! And ... the dislike of "experimenting with student learning".* [53]

A further contributory factor was perceived to be due to a lack of resources [76]. One respondent referred to the "constant battle for resources" [17]. Time was needed to create the resource and for the effective delivery and maintenance of the CAL program [46].

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[2] [*x*] references in italics apply to respondents to the postgraduate education survey

CAL material soon became out of date [16], therefore old versions required updating [84] and links to external web-sites had regularly to be reviewed [3]. Rapid technical obsolescence and the inflexibility of some packages i.e. "packages must be used as is" [75], caused further problems.

Changing attitudes to CAL was problematic [10, 14], in part due to the difficulty of getting students to a level of computer literacy that is acceptable [1] - a problem which was highly variable with a post-experience i.e. mature, audience [*138*] - and the student "culture of paper-based learning" [26]. Low take-up by poorly motivated students and the creation of "feelings of isolation" and ambiguity of instructions exacerbated the problems encountered in CAL delivery [75].

There was a view that CAL materials could do more damage than good if they were poorly designed and implemented [43].

> *You must use CBL [computer-based learning] appropriately. There is no point in just giving it to a student unless there is point to them using it and the benefits are clear.* [72]

The design and implementation of group work on-line and the development and support of active learning communities is another key issue [52]. It was deemed important for students to feel part of a group [41]. Poorly designed CAL, inadequately integrated into other resources, with a loss of quality interactions with students, were perceived to be common drawbacks of CAL resources [75]. Moreover, creating and finding good content was sometimes difficult [14, 33].

Unfortunately, computer-mediated conferencing for seminars had variable take up [61] and communication breakdowns had occurred [1] due to pressure of work on the tutor, availability of students and gaps in continuity of work by students [*57*]. Indeed a variety of technical problems had been experienced [5, 41]. These included uploading files [*48*, *63*], network crashes [67] and failed distribution media [67].

5.9 Future development of CAL

The medium used to deliver multimedia resources is an important consideration in the future development of CAL (Question 14). Many respondents favoured web-based delivery [7, 43, 47, 50, 58, 59, 70, 81]. Cross platform issues, one respondent suggests, will become easier to resolve and as a consequence, Javascript and DHTML will replace the "Director type" packages [70]. Other respondents forecast, that in this same period (2000/05), there will continue to be development of standalone CD-ROM applications [16, 19, 66, 78].

However, delivery over the Internet is dependent on issues such as licenses [7] and the availability of higher bandwidth to peoples' homes [53, 61, 70, 78] enabling increased and effective use of multimedia on-line [41,46]. A seamless interface between CAL software and central course administration is envisaged [46] that would make course delivery more responsive and efficient. Not that integrated systems are currently available:

> *Until technology within organisations is updated and the infrastructure is provided, both technically and [in] the education of tutors etc., it wont change a great deal. Once the above does happen then perhaps people's predictions and distance learning, especially in the postgraduate setting, can be reassessed.* [69]

Delivery through digital television and mobile phones following the introduction of 3rd generation (3G) technology [79], is forecast. The PC would no longer be the sole on-line learning tool [46]. One respondent referred to the possible use of "work tablet" and the future demise of the PC [67]. Thus technology will become more portable [57] and "wireless" [44, 67].

The transition from one medium to another, one respondent believed, would be "messy" [3]. Regretably a vast increase in poorly designed and ill thought-out courses, based on existing materials, may be "dumped" on the Web [3]. Only a slow increase in high quality, expensive educational software is predicted [3]. The challenge would be to chart a middle course.

> *Networked learning - of people and resources allows us to shift the emphasis back to learning and teaching issues and not technological issues. The social (constructivist) learning aspects (e.g. group work) are now central.* [52]

A more optimistic view, expressed by other respondents, suggests that there is likely to be increasing availability of well constructed material [10, 22, 71]. Such resources would be regarded as a "standard delivery system", not merely for enthusiasts or pioneers [57]. Web-servers would track usage [78] and resources would be readily and easily kept up to date [47, 70].

CAL resources will be more reliable [57] and incorporate more images, on-line assessment and skills development [36]. More emphasis will be placed on multimedia interactivity [23, 53, 57], in-package guidance and navigation [41]. CAL will also provide opportunities for enhanced communication between students, in the form of chat rooms and forums [70]. On-line discussion i.e. real time and asynchronous communication, will support delivery via current "multimedia materials" [56, 61] and offer students an enhanced learning experience.

Indeed this shift of emphasis from the technological issues to pedagogy was raised by a number of respondents [18, 40, 78].

> *I would hope that the needs of the learner in relation to their educational aims would increasingly become the drivers for CBL [computer-based learning] design and delivery, rather than the "here's the technology, now what shall we do with it" scenario which has prevailed.* [83]

Better pedagogy would result from greater experience of what really works [78]. Evaluation, it was cited, would become more rigorous with advances in professional teaching development brought about by the Institute of Learning and Teaching [58].

> *In general it will become more open access, but like most of the hype in the past, the future will over 5 years, not be significantly different at the ground floor - technologies change fast - teacher's culture does not! TLTP has evidenced that fact constantly.* [20]

Other drivers, which may promote wider use of CAL, are initiatives such as the National Grid for Learning and the University for Industry [78]. A change in "social protocols may also accelerate such change [towards CAL], as communication becomes easier" [41]. Changing culture will widen acceptance [18] although concern is expressed that CAL would not "extend learning" - cost would be the driver [40].

> *At present cost [in development] is too high for very short lifetime and I don't see this changing in the near future.* [33]

Integration into existing provision, institutional collaboration and flexible delivery [1, 56, 59, 84] would lead to a reduction in lecturer produced materials unsuitable for use by other institutions [56]. Less emphasis would be placed on specific learning packages [1] - the consequence of limited availability [40] - and there would be a move towards generic, customisable shells [56].

Rather than replace teaching, CAL should supplement existing delivery [40, 68]. Embedding CAL into traditional teaching forms, it was suggested, would enable transparency and a focus on learning rather than infrastructure [68]. The material should be in "bite-size" chunks, customisable and adaptive to the user profile [16].

Not surprisingly opinion varied as to the value of CAL. Some respondents suggested that CAL will be used for the wrong reason [17] and that similar mistakes will made, with regard to web-based delivery, as they were with earlier instructional programs [72]. Indeed for some this was clearly an emotive subject. Sentiments such as "more of the same useless rubbish" [5] were expressed.

Other respondents were confident about the future development. Rapid growth was envisaged in the corporate training market [12, 13] and HE, although this would be dependent upon the particular subject or discipline [62]. CAL would lead to more

realistic and authentic learning [43], be more pedagogically sophisticated [57] and more student centred and controlled [53]. Better pedagogical support for staff would be available [41] and with more "new blood", so there would be yet more CAL delivery [73].

5.10 International survey

5.10.1 Method

The relatively small proportion of distance learning activity uncovered in the U.K. built environment sector (refer to Section 3.7.1) prompted an international survey. A preliminary review of built environment education web-sites suggested that email contact particulars were more readily available than postal details. This observation combined with the associated benefits of nominal distribution costs and immediacy, influenced the decision to develop an email survey. However, concern that questionnaires, distributed as email attachments, would appear "clumsy" and result in a poor response, led to the development of an on-line form, directly accessible from the mail text.

The "Distance Learning" aspect of the questionnaire (refer to Section 3.3) was translated into web format using SPSS Data Entry Builder (v.1.0). A review of companies offering CGI scripts was undertaken, in collaboration with Learning Information Services staff at Leeds Metropolitan University. The nature and context of the survey together with the length of form, produced in SPSS Data Entry Builder, informed the evaluation process.

The criteria used for selection of the company were:

- Capacity to accommodate form;
- Adequacy of feedback data;
- Log-in facility;
- Reputation and status of company; and
- Lack of advertising

However, no company was found that offered a product capable of satisfying all the listed criteria. The company whose application most closely matched the specification i.e. "Cut and Paste Scripts" designed and developed by British Bulldog Software, was approached and a bespoke script was produced.

5.10.2 On-line questionnaire structure and design

Form design (refer to Figure 5.6) mirrored that produced for the U.K. survey and password access[3] was provided via http://www.lmu.ac.uk/hcn/benv/survey. A series of pilot questionnaire "returns" were completed in order to refine the presentation of the data, which was forwarded automatically to Microsoft Outlook. The CGI script was unable to display nil responses therefore manual copying of the data into the SPSS was necessary.

5.10.3 Sample

Postgraduate distance learning courses in Built Environment related disciplines were identified from the following sources:

- OUHK Electronic Library (http://www.lib.ouhk.edu.hk/dli/home.htm);
- Gradschools.com (http://distance.gradschools.com);
- University Continuing Education Association (http://www.nucea.edu); and
- ConstructionEducation.com (http://www-icdl.open.ac.uk/icdl).

Emails were tailored to reflect the nature of the contact e.g. an individual, admissions or course information. In total 45 distance learning postgraduate courses were identified. Eight responses to the questionnaire were received and two further replies made reference to web sites, providing comprehensive details of their distance learning program.

[3] Password access "distance"

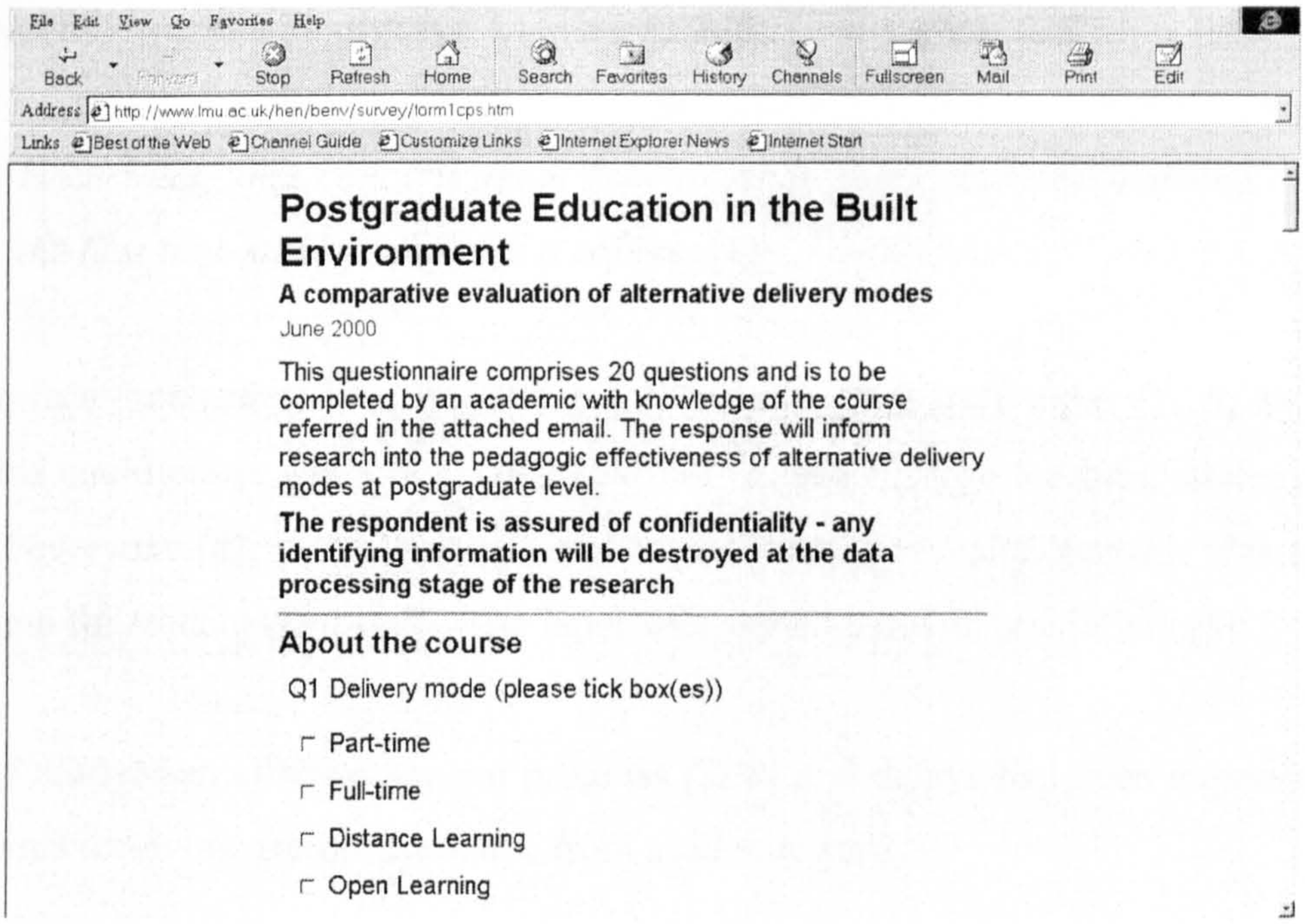


Figure 5.6 On-line questionnaire

5.10.4 Findings

Despite a disappointing response to the email survey, the data received did reinforce some of the issues previously identified in the UK study. Distance learning courses were delivered mainly in multi-mode format, were of varying age (i.e. between 6 months and 23 years) and had total student numbers across the range of categories provided in the questionnaire.

Text-based learning materials were used by all respondents, again with little use made of audio. However, in addition to video and IT related technologies, "live" satellite viewing and ISDN video conferencing were key delivery features on two of the courses.

Surprisingly little weight was attached to cost in the providers' decision to develop distance learning resources, whereas access and pedagogy were perceived to be of greater importance. Reflecting the views of academics in the UK study, novelty and speed were of least importance in the decision making process.

Problems associated with distance learning echo those in the UK study.

> *Uncertainty and concern about how to study using distance learning, the first time students do such a course.* [1]

Face-to-face interaction was important for students and staff alike [1, 5, 6] and problems could ensue when interaction did not occur [7]. The teaching strategy did not suit everyone [8]. A "follow-up" exchange of emails revealed that this was again a problem for students and staff. The latter was associated with plagiarism [8].

Lack of motivation affected student progress [2, 8] and delays had been experienced in students receiving prompt feedback from academic staff.

> *Distance learning students often fall behind and take extra months to complete a course.* [2]

The cost of staging a program together with on-going resource issues such as the time spent attending to telephone and email queries from students [6] was raised by one respondent. Others referred to organisational difficulties i.e. maintaining the technology [3] and registering and paying for charges remotely [8].

5.11 Summary

The findings of the CAL survey indicate that the principal factor influencing the development of CAL is related to pedagogy. Although there is some suggestion that this may be of universal concern, the response rate for the international survey is very disappointing, and great care must be attached to all observations made in this context.

Respondents suggest that the learner benefits derived from CAL enable students to learn by discovery and learn at their own pace, and allow the resource to be used for revision and for future reference. However, the problems associated with CAL are of a cultural and technical nature. The former concern includes a range of student, staff and institutional issues, while the latter is primarily linked to web-based facilities.

Opinion differs regarding the future direction of CAL, but there is a consensus view that delivery will be predominantly web-based and that greater levels of pedagogic support will enhance its effectiveness.

These findings are used to inform the development of DIME^{PM} courseware. Minimum platform specifications, preference for VLE software applications, and the perceived importance of user-related CAL features influence the "microdesign" (Jarz *et al*, 1997) of the educational program, which are discussed in Chapters 6 and 7.

Chapter 6

Design imperatives for instructional multimedia programs

6.1 Introduction

Benyon *et al* (1997) define multimedia development as the selection, design and production of multimedia components. Unlike the instructional design stage, which is concerned with the pedagogic approach and structure of an educational program, multimedia development focuses on the media used to deliver the course. Concerns that academics, when urged to transfer existing educational materials into digital format suitable for CD-ROM or the Internet, simply add sound and images without proper consideration of the medium, abound (Stemler, 1997; Stoney and Wild, 1999; Fowler and Mayes, 1999; Riley and Gallo, 2000). Poorly designed materials, they argue, do not intrinsically motivate students to make use of the resource or learn from it. Such sentiments are echoed by respondents in the CAL survey (refer to Chapter 5).

Rimar (1996) states that a multimedia designer requires "an artistic sense of layout and balance, creativity and a background in audio-visual media". Screen based programs, he continues, are more sensitive to "message design quality" than their paper based counterparts. He, like others (Marshall *et al*, 1987; Wagner, 1988; Clarke, 1992; Davies and Brailsford, 1996), suggest guidelines for the designer.

In order to become designers of effective multimedia, educators must develop task and content expertise (Sherry, 1998). Sherry states that educators need to acquire:

- cognitive strategies for developing approaches to design;
- procedural knowledge about the steps in developing interactive multimedia modules;
- declarative knowledge about the principles for effective multimedia design; and
- problem solving skills in developing instructional design for specified audiences.

Chaloupka and Koppi (1998) challenge multimedia designers to create learning environments that will enable students to examine, perceive, interpret and experience information, so that they might convert this information into knowledge. They believe that interactive media will only satisfy these goals when users can visualise and understand complex relationships in ways that are not possible in other media.

Good design is crucial to the success of CAL and, it is posited, will benefit from a process-oriented approach. Developmental models reinforce this viewpoint (Driscoll, 1998; Passerini and Granger, 2000). This chapter outlines the formative stages of Driscoll's (1998) 12 step plan in the context of DIME^{PM} prior to a discussion of the design principles and structural considerations put in place to satisfy the aforementioned pedagogical approach (refer to Chapter 4). Technical issues associated with the implementation of DIME^{PM}[1] design imperatives are addressed later, in Chapter 7.

6.2 Formative evaluation of DIME^{PM}

Shinkins (1995) defines formative evaluation as a collection of "data which can provide insights so as to revise instructional material in order to make it more effective and efficient" as opposed to summative evaluation which "will see how effective the final version is". The distinction is helpful in interpreting Driscoll's (1998) developmental model. It is contended that steps 1-9 provide a sound framework for the development of a robust multimedia educational programme, worthy of comparison with established traditional delivery methods.

Driscoll states that the purpose of a "pilot" [Step 1] is to determine whether it is technically possible to produce and deliver multimedia resources. Early development work (Ellis and Riley, 1997b) had established the feasibility of converting existing materials into substantive pieces of educational courseware and had identified key operational and design issues relevant to the distribution of DIME^{PM}. Clearly, the occurrence of major technical problems would distract users from the aim of the evaluation i.e. to determine the pedagogic effectiveness of CAL.

[1] Adrian Riley, Head of the Capability Learning Support Unit (CLSU) within the Faculty of Health and Environment at Leeds Metropolitan University, was responsible for the graphic design of DIME^{PM}.

Of prime importance, however, before embarking on further development of a project management resource was the need to consider whether to write, buy or adapt supporting materials. A review of technology-based training courses prepared by Tucker (1997) identified eleven project management educational software applications. Each product incorporated relevant material, but not surprisingly, no one package matched entirely the Project Management module specification (refer to Section 4.5). The option of using such materials to complement an in-house multimedia package was ruled out on the basis of cost[2].

Support for the development of a bespoke learning package was obtained from the Academic Registry at LMU [Step 2]. Funds were allocated from the University's Open Flexible Learning (Phase 3) initiative and a core project team was created [Step 3]. The core development team comprised three graphic designers and two members of academic staff. The importance of employing a graphic designer's skills is crucial to the successful development of multimedia products (Apple, 1986). Marshall *et al* (1987) concur. They argue that strict adherence to design guidelines is insufficient. On their own guidelines "do not tell the designer how to do exactly the right thing" (Marshall *et al*, 1987).

Evaluation criteria were developed [Step 4], based upon the characteristic features of a CAL environment (identified in the CAL questionnaire - refer to Section 5.3), and five postgraduate students volunteered to "test" the pre-release version of DIME^{PM}. Data would be gathered by direct observation, completion of rating scales and focus group discussions [Step 5].

In order to facilitate a comparative longitudinal evaluation of alternative delivery modes no changes were made to the module's stated learning outcomes [Step 6]. The content for each Unit was prepared by the module team and by practitioners who delivered the guest lectures during delivery of the part-time course in the preceding year (1999/2000).

[2] Purchase prices for Project Management software varied between £165.00 - £2880.00 (Tucker, 1997)

The medium and the software used for the delivery of CAL were contentious issues [Step 7]. Commenting on the relative strength of CD-ROM and the Internet, Sandelands (1997) observes that the former is comparatively straightforward to deliver and easy to access and use. A CD-ROM provides archived resources that can be reviewed and edited and the information it contains can be retrieved using intuitive navigation controls. Williams (1998), also a keen advocate of CD-ROMs, believes they offer "too many advantages for them to be replaced by the Internet". Not only do "consumers like to own things", they also realise that downloading costs money and is time consuming.

However, Sandelands (1997) does recognise that, like their paper-based equivalent, CD-ROMs tend to be out-dated before they have been distributed and that there is little opportunity to access "real-time" information. The benefits the Internet can offer are:

- Email to transfer text and multimedia messages;
- Cheap, synchronous and international communications; and
- World Wide Web access to an array of on-line resources.

Grantham and Hunt (1999) reinforce this latter point, stating that among the many benefits of a web-based approach is the ability to access "unbounded multimedia links to thought-provoking sites". Furthermore the Internet encourages students to tailor learning to their individual needs and to take responsibility for their own learning. Carswell (1998) offers a note of caution in this respect. He argues that the Internet might also impose an extra cognitive load upon students who are ill-prepared to access the Web. Seale (1999) is more critical, believing that the Internet may "disarm" students and thereby deny them "a rich learning experience". Benyon *et al* (1997) are sceptical regarding the supposed pedagogic benefits arising from "hypertextualising" existing course material and somewhat chastened by the experience of developing web-based programmes. Courses that are primarily text based, they argue, may as well be presented in book form. They conclude that an incremental approach driven by sound pedagogy is vital.

Pragmatic considerations further constrain the development of web-based learning packages. In the context of this study, copyright restrictions imposed by publishers, limiting reproduction on CD-ROM to 25 copies/annum and prohibiting Internet delivery of certain materials, were problematic. The need for identical subject content, combined with technical problems associated with the distribution of CAL materials (refer to Section 7.6) lent weight to the argument that web-hybrid CD-ROMs offered an acceptable compromise.

A survey of authoring software undertaken by Murdoch (1995) revealed two main "players" in the education multimedia market. Namely, Asymetrix Toolbook and Macromedia Authorware Professional for Windows (Authorware). Both companies held an equal share of the market when Macromedia's sister product, Director, was combined with Authorware. Authorware utilises a series of icons e.g. display and movie icons, to suit the particular needs of the piece. Although *prima facie* this reduces the need to program simple applications, the full potential of the software is only released when scripted routines, using Authorware's system variables, are written. Asymetrix Toolbook adopts a script-based model format, offering lower-level control of objects. As such, the software provides a programmable means of authoring applications.

The principal constraints upon the choice of software were:

- exclusive use of IBM compatible PCs within the School of the Built Environment at LMU; and
- flexibility i.e. the ability to run authored pieces on Microsoft Windows 95/98 and NT environments.

Neither constraint precluded the use of either the flow-chart based or script-based model. However, earlier developmental work (Ellis and Riley, 1997a; Ellis and Riley, 1997b; Ellis *et al*, 1998), had resulted in considerable experience being gained in the operation of Authorware. Enhancements in version 5.1 increased further Authorware's functionality and enabled the seamless integration of QuickTime VR scenes, video controls and links to default browsers. The program also incorporated "Shockwave" facilities, allowing authored pieces to be packaged for delivery on the Internet and Intranet at LMU.

Moreover, the introduction of Knowledge Objects (KOs) i.e. pre-programmed "wizards", automated repetitive tasks e.g. launching default browsers (refer to Section 7.6). The selection of authoring software [Step 7], therefore, was made earlier in the development process than envisaged by Driscoll, the decision to use Authorware being heavily influenced by the expertise which existed within the School. However, the findings from the CAL survey reaffirmed the popularity of Authorware and identified valuable "directions" for the further development of CAL resources during evaluation and testing.

One major concern expressed by respondents in the aforementioned surveys was the effect CAL might have on motivation. It is a view shared by Cornelius and Heywood (1998) who observe that distance learning students tend to feel a sense of isolation and tend to become de-motivated. One means of overcoming such problems, is to harness the enhanced communication facilities offered by the Internet (Wilson and Whitelock, 1998). Hughes (2000) agrees, but perceives current bandwidth restrictions as a major constraint. In this study major technical hurdles in distributing DIME^{PM}, downloading files, operating Internet-based video conferencing and accessing streamed audio and video, severely limited the potential of web-based delivery (refer to Section 7.6).

To realise the benefits gained by linking tutors with students and more importantly students with their peers (Wilson and Whitelock, 1998), the decision was made to create a "hybrid" CD-ROM which incorporated a virtual learning environment (VLE). The findings of the CAL survey (refer to Chapter 5) provided further insight into current practice. Predictions that distance learning might be enhanced by the use of a web-based conferencing, provided the stimulus to integrate a VLE as an acceptable compromise between standalone and Internet delivery. A Learning and Information Services Working Group at LMU (2000) undertook an evaluation of three VLEs i.e. Learning Space, WebCT and Blackboard. Their report rejected Learning Space but found relatively little difference in the features offered by the latter two products. In this research study, however, selection was influenced by cost. WebCT offers a 120 day developmental period without charge, but a subscription fee is payable for each student enrolled on the course. Hence Blackboard CourseInfo, which offers a free service with limited server capacity (i.e.5 Mb) and help facilities, was chosen as the complementary VLE to DIME^{PM}.

Having packaged the Authorware piece and decided upon the VLE, students were informed, prior to enrolment on the module, that they would be taking part in a research study exercise [Step 8]. "Dry runs" [Step 9] of DIME^{PM} were an integral part of the formative evaluation process - the responses of the five postgraduate students identifying a succession of technical, design and pedagogic issues to be addressed prior to implementation and the subsequent summative evaluation of the multimedia delivery mode[3]. As Benyon *et al* (1997) conclude, courseware development is an iterative process that relies on the development of prototypes and redesign. This view is supported by Jarz *et al* (1997) who recognise the iterative nature of the multimedia design process, referring to "macrodesign" (akin to instructional design), that sets out the educational goals and framework, and "microdesign" (a combination of multimedia development and integration). Microdesign, they state, relies upon an interplay between the user interface and the "concept of roles" (refer to Section 6.8) and must ultimately fit within the overarching macrodesign framework.

6.3 DIME^{PM} structure

The importance of structuring knowledge is perceived to be a key factor which impacts upon effective understanding (Davalos, 1997; Benyon *et al*, 1997). Subsequent analysis of the content in the module was undertaken by the module team and the learning materials were sub-divided into discrete "chunks". The structure adopted for traditional delivery of the Project Management module is consistent with the multimedia instructional design methodology articulated by Steed (1999). The module is divided into four Units i.e. Project Perspectives, Tools and Techniques, Interpersonal Skills and Projects, each of which develops pre-defined outcomes and competencies. All Units, with the exception of "Projects", are further sub-divided into Topics and Learning Points (refer to Figure 6.1).

[3] Delivery of the program, data gathering and recommendations (i.e. Steps 10-12) are contained in subsequent chapters of this dissertation.

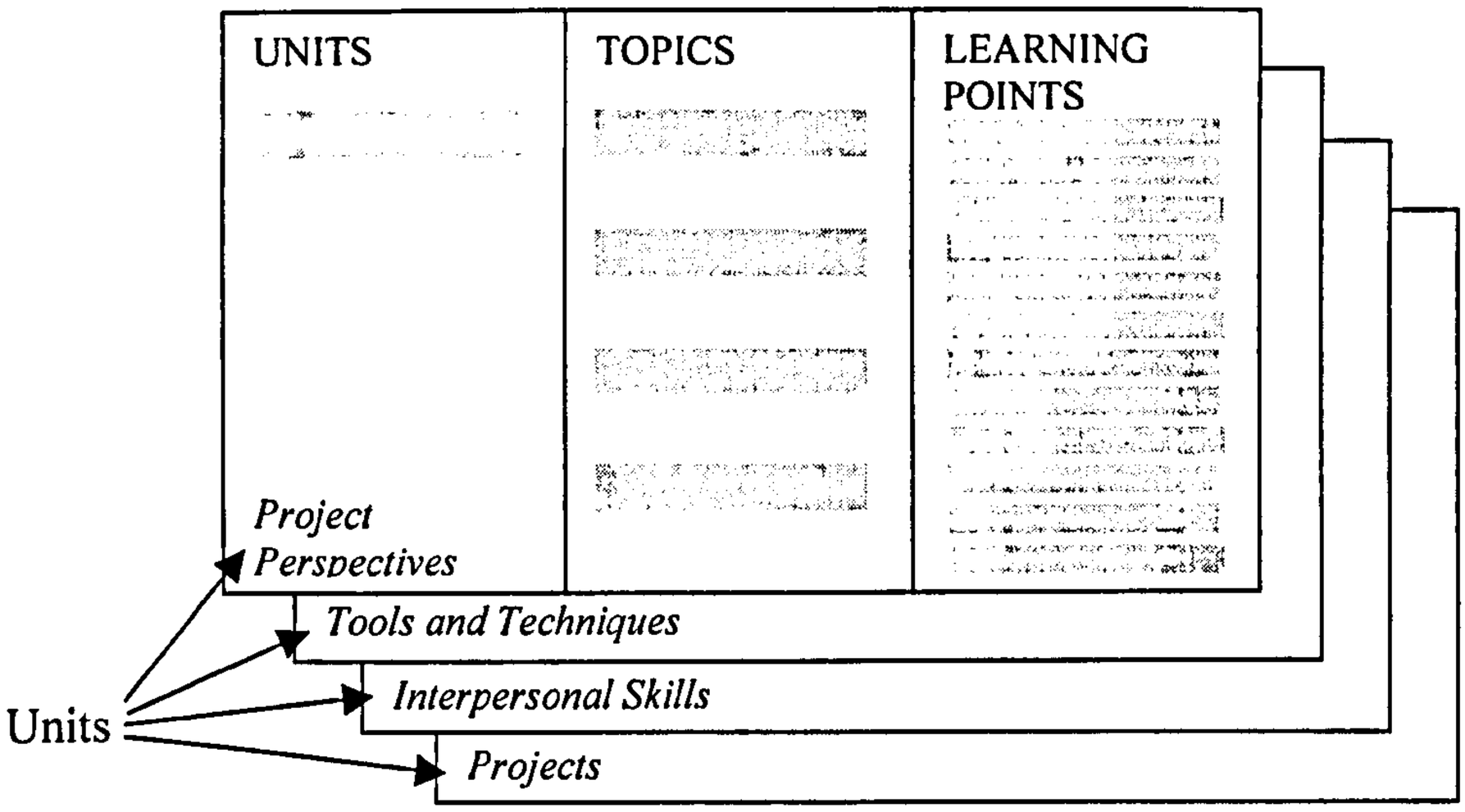


Figure 6.1 Framework within DIME[PM]

The "Projects" Unit, however, contextualises learning, by reference to case study material comprising two projects, namely the A1-M1 Link Road and the Greenwich Peninsula. In addition the Units provide a unique set of learning activities, affording the student a "rich" resource. Illustrations, audio and video footage, direct links to relevant web-sites, electronic journals, synchronous and asynchronous communication and interactive exercises create an environment, which is intended to transcend the metaphor of the "computerised textbook".

6.4 Learner control

Wild and Quinn (1998) encourage the development of an internal locus of control in instructional multimedia, thereby increasing the likelihood that learners develop "deep" approaches to the tasks presented. Learner control concerns those aspects of the interface and instructional design that allow learners to navigate through content and choose the nature of the feedback they receive (Stoney and Wild, 1998).

6.4.1 Navigation

Marshall *et al* (1986) stress that the ease of navigation is an important determinant of learning. Hypermedia and multimedia documents, unlike traditional paper-based material, enable users to access information in a non-linear, random manner.

Authorware uses built-in hypertext functions to create links within an authored piece. Lawless and Kulikowich (1998) suggest that the use of hyperlinks within educational software is dependent upon the differing navigational profiles of readers i.e. knowledge seekers, feature explorers and apathetic users. The "knowledge seeker" adopts a systematic approach to gathering information from screens that contain material needed to aid learning. "Feature seekers", however, explore educational software for special effects, such as movies, animations and graphics and "apathetic users" adopt no logical pattern to navigation during their brief visits to the computer. They conclude that domain knowledge and interest, influence the navigation paths of individuals. Students possessing either high or low domain knowledge are less likely to explore the text for useful material than those users who possessed average knowledge. Likewise, Lidstone and Lucas (1998) also highlight the importance of the learner's metacognitive capacities i.e. the ability to reflect actively upon and regulate one's own thinking by planning and monitoring progress toward a learning goal. DIME^{PM} users are encouraged to reflect upon their own metacognitive skills via a LSQ (similar to that devised by Honey and Mumford, 1986) and are offered different tools to navigate through the content.

The tension between too little and too much freedom in navigating through the learning material is recognised by Benyon *et al* (1997). Too much freedom, they suggest, results in students becoming "bewildered". The coherence of the original structure is then lost. Paolucci (1998) advocates a "branching" structure to achieve a balance between the freedom to navigate a knowledge base and the need to ensure that all screens are visited. The concept of so-called "controlled combinational explosions" i.e. the temptation to create many links, Hughes (2000) believes is both a hazard for the user, in terms of navigation difficulties, and the developer, generating considerable authoring work. Once again a balance between high levels of system control and unstructured browsing facilities is recommended. Supported by the necessary "scaffolding" (Bruner, 1972) DIME^{PM} seeks to adopt a "guided discovery" approach (Laurillard, 1993) using the structure of the study guide (refer to Section 6.3) and a range of links to allow movement between Units, track progress and launch interactive activities, graphics and video and audio clips.

Exploratory research conducted by Trumbull *et al* (1992) also examines the way students used a hypermedia system. Their program had three navigational and guidance tools i.e. a normal ambulatory mode (e.g. forward, backward, turn), a browse mode and a guide mode. The latter two were more dynamic and were found to be more enjoyable for the user. Here again the dilemma between a more serendipitous and systematic strategy for locating relevant information was identified. Trumbull *et al* (1992) recommend that designers develop a variety of interfaces, making particular use of the visual metaphor. DIME^{PM} embraced this design imperative. DIME^{PM} combines a menu-driven approach with maps and some sequences of linear programming. As such, it is common to many CAL packages (Whalley, 1998). Forward and backward buttons also allow users to follow a linear, sequential path through the resource and a network approach via the Recent and Menu options together with hyperlinks to web-sites.

Hughes (2000) suggests that this navigational dilemma can be resolved by clarifying the rules of use early in the application and by making use of "rollover" titles and "hot" clickable buttons. The Main Menu in DIME^{PM} (refer to Figure 6.2) illustrates how Authorware's "hot spot", button and display commands can be combined to provide these facilities.

Figure 6.2 DIME^{PM} Main Menu

A series of menus enable students to navigate through each section of the piece, and via Content, select study Units, Topics and Learning Points (refer to Figure 6.3). Limited facilities are provided to link between Units.

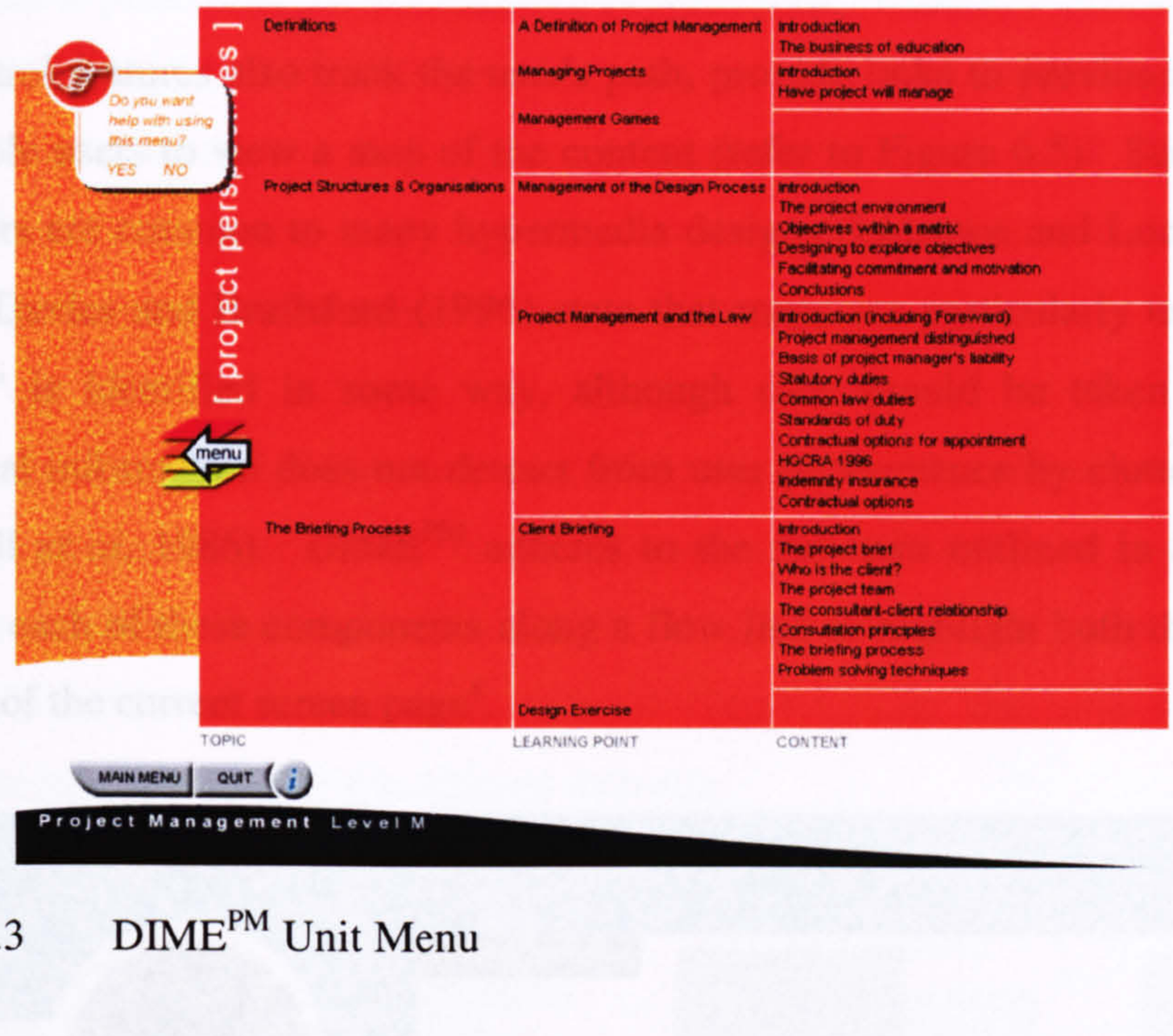


Figure 6.3 DIME[PM] Unit Menu

A range of user controls are also provided in DIME[PM] via a Navigation Panel (refer to Figure 6.4) which is common to all Learning Point screens. Facilities comprise:

- Menu/Main Menu
- Page Navigation (Forward and Backward)
- Recent
- Overview

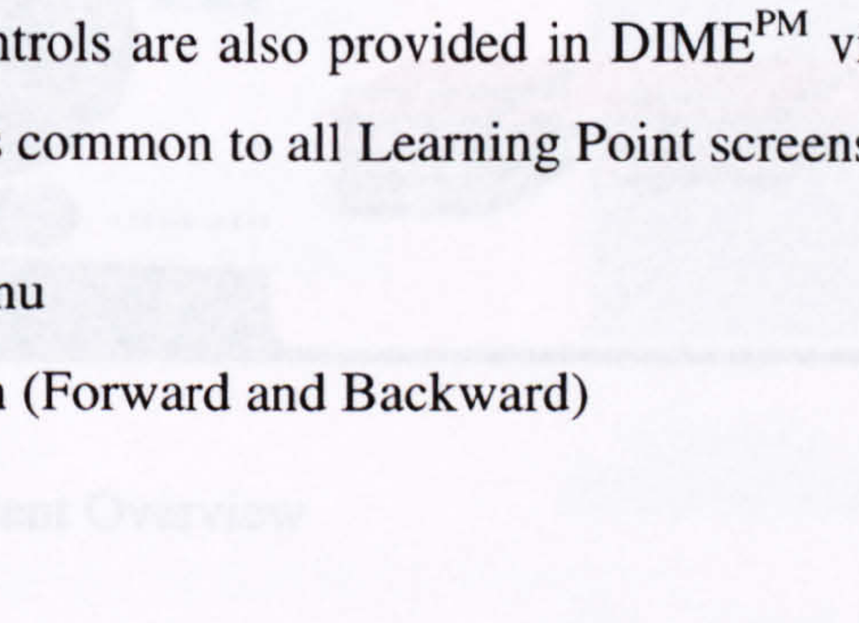


Figure 6.4 Navigation Panel

Buttons that cannot be selected (for example, the forward button when no further pages are contained in the Learning Point) remain "dull" when the cursor passes over the control (as recommended by Marshall *et al*, 1986).

The control features also track the user's path, provide links to previously visited pages and enable users to view a map of the content (refer to Figure 6.5). Such geographical metaphors are common to many hypermedia designs (Lidstone and Lucas, 1998; Hron, 1998). Davies and Brailsford (1996) state that maps are particularly useful if "current location" is identified in some way, although care should be taken to ensure that contextual information does not detract from user performance by cluttering the screen (Marshall *et al*, 1986). DIME[PM] adheres to the structure outlined in Section 6.3, re-ordering each of these components along a flow line to highlight both the user path and location of the current screen page[4].

Figure 6.5 Content Overview

Hypertext links from documents to a series of interactive exercises are a feature of the DIME[PM] package. These exercises mimic the collaborative activities employed in the part-time delivery mode.

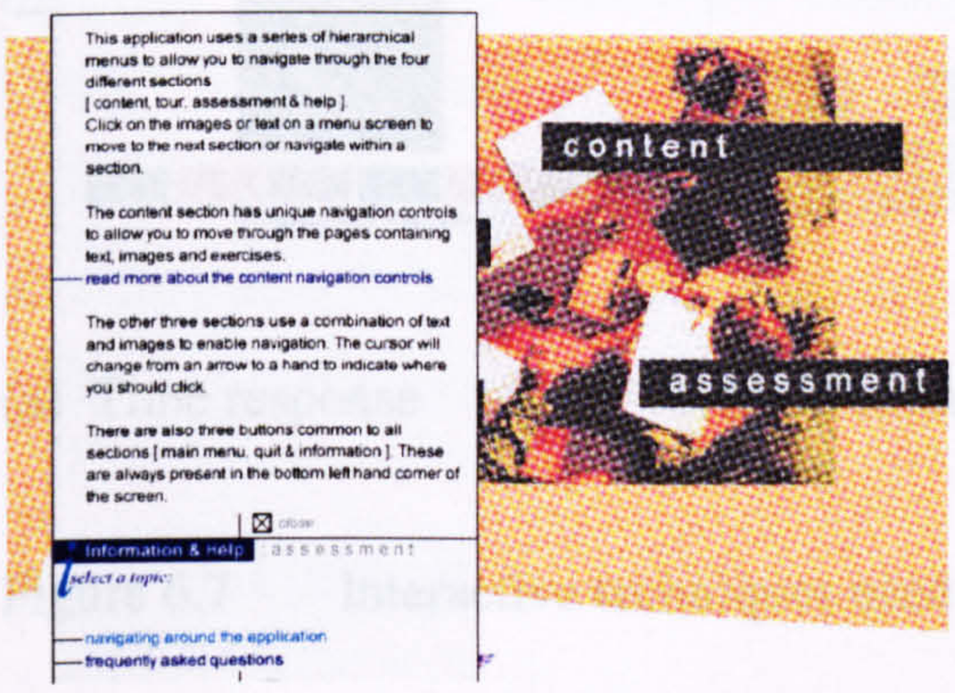
Despite this array of navigational aids, it must be recognised that learners are not always capable of making best use of such facilities (Wild and Quinn, 1998) and there remains a need to provide additional support in less structured environments (refer to Section 6.4.2).

[4] Devised by A. Riley, CLSU, LMU

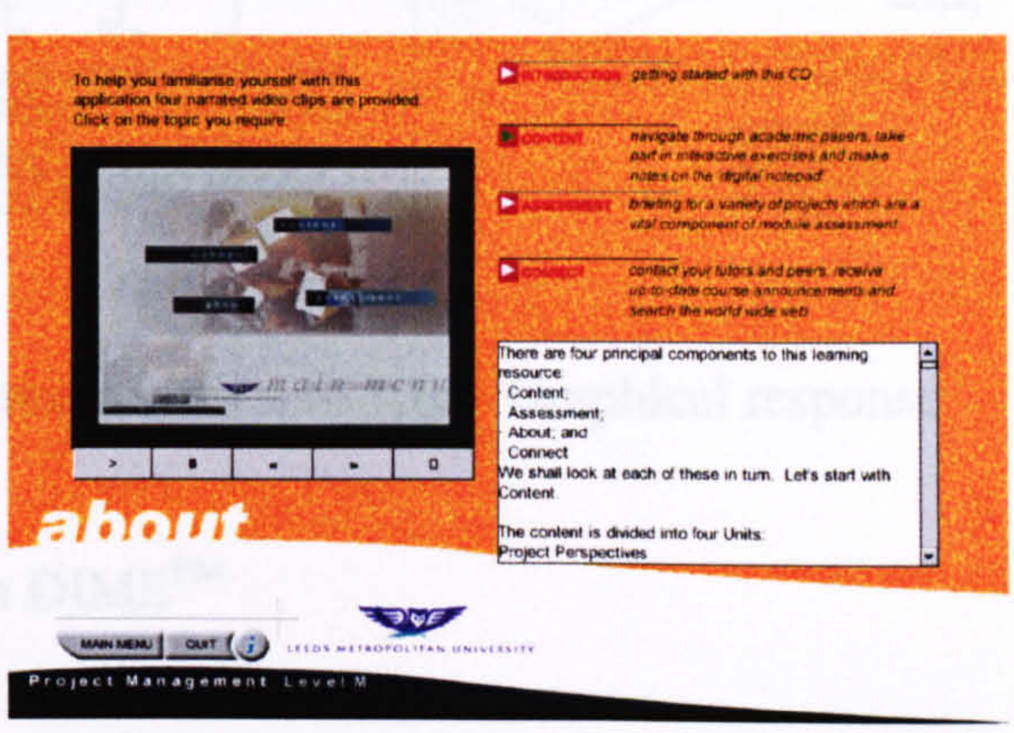
6.4.2 Feedback and support

Clarke and Dwyer (1998) state that feedback is a very important aspect of CAL and that it can have a positive effect on learner's performance. Feedback should tell users what effect their action has had on the program, any possible consequences of that action, the new state of the program and their new location (Marshall *et al*, 1986). Moreover Marshall *et al* recommend that feedback should be presented immediately in a familiar, consistent and appropriate manner.

An information or "help" facility is accessible throughout the resource. The "*i*" button, located in a constant position on the screen, opens a help window "in front of" the users work (as recommended by Hughes, 2000). Instructions on navigation and FAQs are a common feature of all help facilities (refer to Figure 6.6(a)). The latter are supplemented by on-line up-dates via the Blackboard web-site.



(a) FAQs

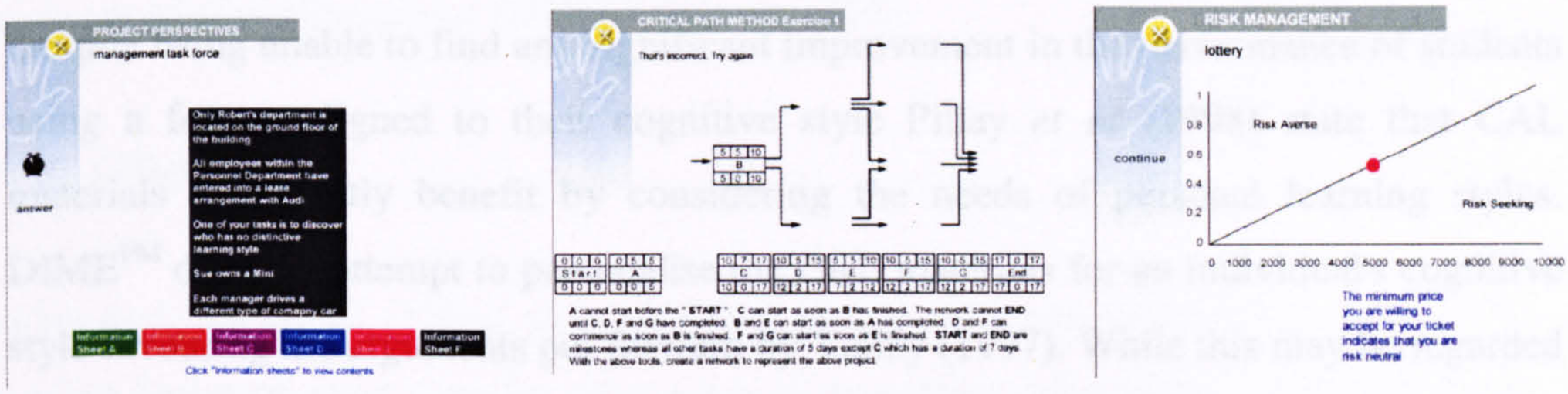


(b) "Help" screen movies

Figure 6.6 Help facilities in DIME^{PM}

Further assistance is provided for the user via the Main Menu in the About section of the piece. DIME^{PM} offers students different levels of assistance. Influenced by the "scaffolding" technique, advocated by Bruner (1972), a series of instructional movies are available for the user (refer to Figure 6.6(b)). A control panel underneath each movie offers similar features to those available on standard VHS recorders and users can choose whether to retain this "help" facility or remove it from the screen. Further tutor support movies within "About" are complemented by a scroll text facility, which is again responsive to user interaction.

Formative evaluations of DIME[PM] reinforced the need for feedback, particularly in the interactive exercises (referred to in Section 6.7). Accordingly, a variety of techniques are adopted to ensure the user is provided with the necessary information (refer to Figure 6.7 a-c). Clark and Dwyer (1998) note that immediate feedback is best for "discriminating learning", whereas delayed feedback is more appropriate for higher level tasks. However their research, which sought in part to determine whether different types of feedback affected learner achievement, found an "insignificant difference" between these two variables. DIME[PM] provides immediate "knowledge of response feedback" i.e. students are told whether their responses are correct or not, and delayed tutor feedback on completion of the summative tasks within the program. Furthermore students are encouraged to contact their tutors to gain elaborative feedback during their studies.



(a) Time response (b) Textual response (c) Graphical response

Figure 6.7 Interactive techniques used in DIME[PM]

6.5 Personalising the learning resource

The need to personalise the learning resource is recognised as a beneficial component of a CAL package (Sotone and Meyer Escoe, 1999). A "Digital Notepad" allows text to be attached to all pages within DIME[PM] (refer to Figure 6.8). User notes are saved to floppy disks as .txt files, a technique used by KPMG on their Skills Tracker CD-ROM (KPMG, 1999). Entering the user name, upon launching DIME[PM], creates a unique identifier on the disk. Hence the learning resource is personalised to the particular user.

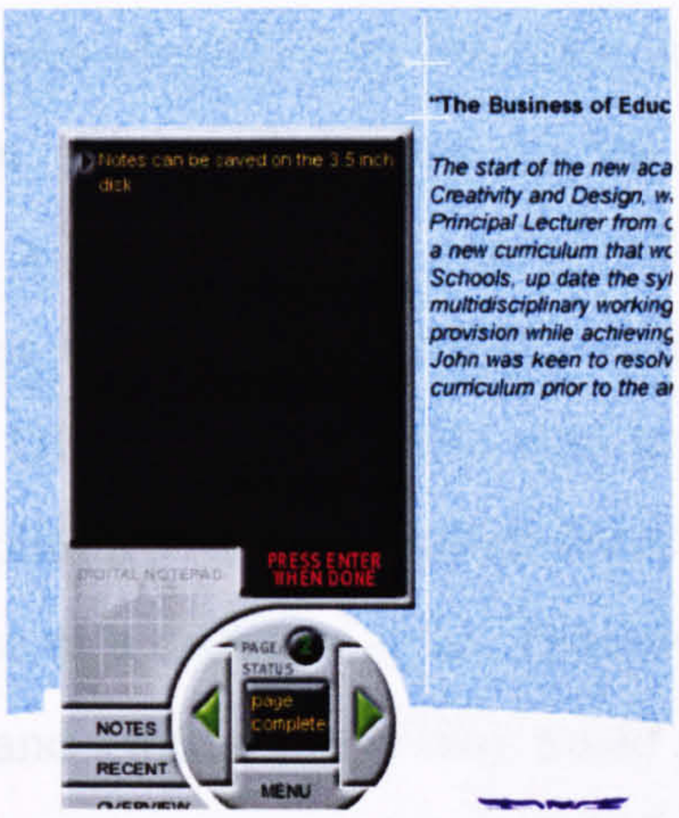


Figure 6.8 Digital Notepad in DIME[PM]

Despite being unable to find any significant improvement in the performance of students using a format aligned to their cognitive style Pillay *et al* (1998) state that CAL materials can greatly benefit by considering the needs of personal learning styles. DIME[PM] does not attempt to personalise the CAL materials for an individual's cognitive style favouring the arguments put forward by Valley (1997). While this may be regarded as a limitation of the program, the impact on the learner is mitigated by the use of a variety of media formats (refer to Sections 6.6 and 6.7)

6.6 Aesthetics

Clarke (1992) expresses concern that most designers concentrate on the design of the whole piece while neglecting individual screen design. It is a view supported by Stemler (1997) who states that screen design is an issue of great importance for multimedia developers. Screen design should focus learners' attention, develop and maintain interest, promote engagement and facilitate navigation (Stemler, 1997). Clarke (1992) explores the principles of screen design and suggests that the following issues should be considered by multimedia developers:

- text;
- graphics;
- colour; and
- use of space.

6.6.1 Text

The general principles identified by McAteer and Shaw (1995) influence the choice of typeface and layout. Eighty characters per line and left justified (right ragged) margins are adopted with a character size around 12 point[5]. Davies and Brailsford (1996) recommend smaller text to aid readability and suggest serif fonts (similar to Times Roman as used in DIME^{PM}) which also tend to provide more space between letters i.e. kerning. Text is split meaningfully within the screen and body text is distinguished from headings by the use of a different style. Frequent paragraph breaks surrounded by wide margins (Davies and Brailsford, 1996) avoid content areas of the screen appearing crammed. Yet barren screens are also avoided as these do not constitute good interface design (Lynch, 1994). Target text densities representing approximately 25% of the screen are applied throughout DIME^{PM} (Rimar, 1996).

6.6.2 Graphics

Davies and Brailsford (1996) state that text is not the most effective type of data, therefore designers must consider other ways of presenting information. Although there are no rigid rules regarding media on a screen, graphics should be as simple and clear as possible (Rimar, 1996). Many of the guidelines for text, are therefore seen to be equally applicable to graphic information.

Marshall *et al* (1986) state that graphics and, in particular, icons are a valuable means of facilitating user-system interaction. Rimar (1996) observes that graphic user interfaces (GUI) are becoming standardised and that certain buttons or icons convey very particular messages. Designers are advised to recognise these conventions in their programs.

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[5] Agreement on the use of serif fonts is not universal. For example, Rimar (1996) recommends a sans serif font. However, these guidelines are part based upon a computer display of 640 x 480. DIME^{PM} adopts an 800 x 600 display.

A series of "buttons" in DIME[PM] provide the prompts for student interaction (refer to Figure 6.9 a-e). These are made more meaningful by the use of abbreviations adjacent to the icons (Clarke, 1992). However, Hughes (2000) cautions against the overuse of animated buttons, as they serve only to add "virtual noise". DIME[PM] makes sparing use of animation i.e. for audio sequences, where it is contended that a "speaker" graphic is helpful in prompting users to adjust the volume level on their PC if nothing can be heard.

(a) Exercise (b) Figure (c) Hint (d) Media (e) Web link

Figure 6.9 Hyperlinks

Universal icons are used elsewhere for the operation of video sequences within DIME[PM]. Stemler (1997) urges multimedia developers to use these icons wherever possible as they avoid students having to learn new, possibly abstract concepts.

6.6.3 Colour

Clarke (1992) lists a number of preferred colour combinations. These include blue/black with a contrast of 11 per cent. Stemler (1997) advises designers to use colours sparingly and consistently. Indeed Davies and Brailsford (1996) suggest that seven colours on a screen is about the optimum. These recommendations are applied to all Content screens in DIME[PM]. Rimar (1996) also recommends that 8 bit colour is used if the instructional program might conceivably be distributed via the Internet. Colour "banding" was evident on systems supported by 8 bit graphic cards with 256 colours, therefore graded backgrounds were replaced with uniform "block" colour.

6.6.4 Use of space

McAteer and Shaw (1995) state that the overall layout of the screen influences the ease with which the user approaches the content. They advocate the "Golden Rule" i.e. a one third to two thirds division, as being most aesthetically pleasing. It is a principle that is also favoured by Wagner (1988) and is used throughout DIME^{PM}. Rimar (1996) states that consistency of location is significantly more important in multimedia design than in paper-based materials, and that efforts to make the GUI intuitive will be repaid by quicker and easier access to information. Clarke (1992) also suggests that the display is divided into functional areas and that these should be applied consistently in the piece. This approach is also helpful from a designer's perspective, as it allows graphic elements to be re-used from screen to screen. Figure 6.10 illustrates the functional divisions adopted in DIME^{PM}.

The Navigation Control Panel is located at the bottom left of the screen since the user is most likely to use those buttons after digesting the information on the screen (McAteer and Shaw, 1995).

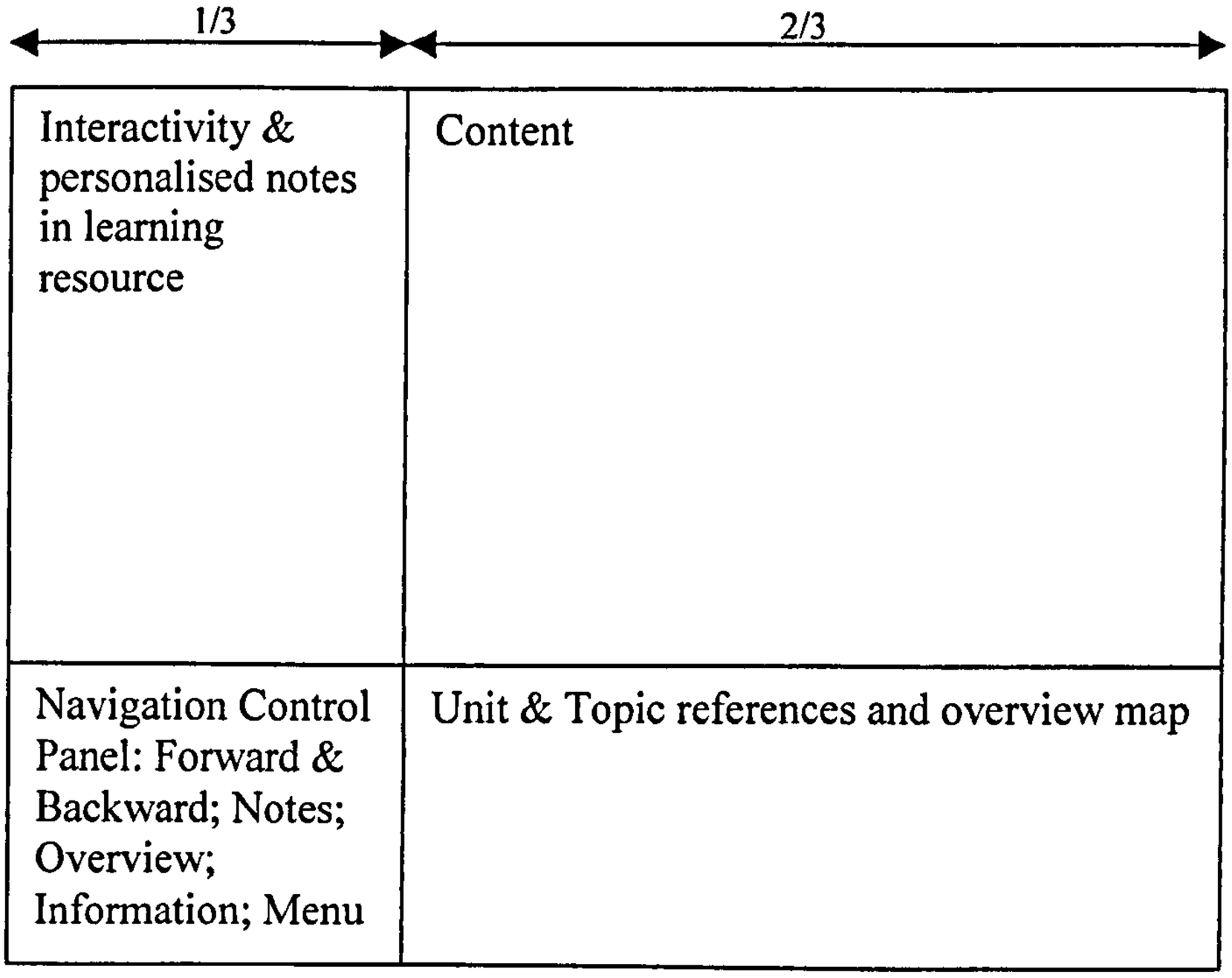


Figure 6.10 Functional divisions in DIME^{PM} screen layout

Functional divisions within each Content screen in DIME^{PM} conform to a standard template. Text style is applied consistently and location details i.e. Unit and Topic references, are placed at the bottom of the screen. Marshall *et al* (1986) suggest that many design guidelines tend to concentrate overly on aesthetics. Features such as lettering and colour, they argue, can also promote efficient memory use. Logical and functional relationships between items on any given screen, therefore, are reinforced by careful selection of text font, size and colour. It is recommended that these issues are considered in the context of screen design (Recommendation 123, Marshall *et al*, 1986).

6.7 Interactivity

The essence of good multimedia learning design is interactivity (McAteer and Shaw (1998); Stefanov *et al*, 1998). Stoney and Wild (1998) define interactive multimedia as computer-based programs based in a variety of media, in which the user actively participates. Interactivity assumes each learner receives "a reaction to what they have themselves put into the system" (Tucker, 1990).

Buttons and menus, Stoney and Wild (1998) state, can be used to force the learner to explore a range of options that lead to high levels of engagement. However, they also recommend that developers should not overuse such features. If interactivity is essential to learning other, more engaging problem-solving activities are needed. A variety of student-centred activities, therefore, are incorporated in DIME^{PM} to enable students to practice their learning and gain immediate feedback. It is recommended that there should be formative activities in addition to summative assessments (Dewald, 2000). A complete list of the formative exercises incorporated into DIME^{PM} is provided in Section 7.5 together with the various types of interaction used. For example, a sequence of critical path method exercises, in the Unit "Tools and Techniques", provide students with the opportunity to construct networks, calculate early and late times and identify the critical path (refer to Figure 6.11). Other interactive exercises in DIME^{PM} take the form of observations, checklists, management games, psychometric tests and models.

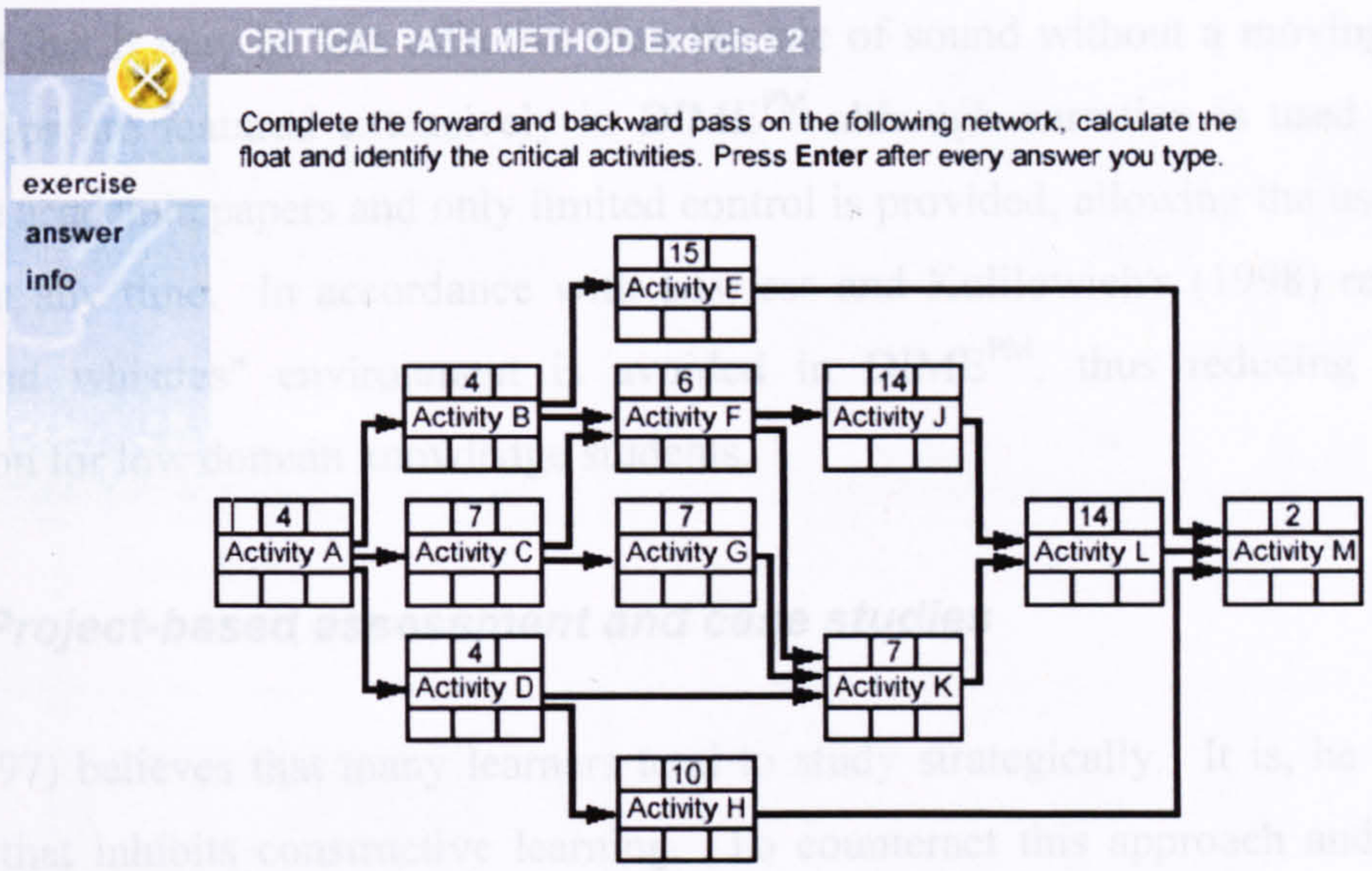
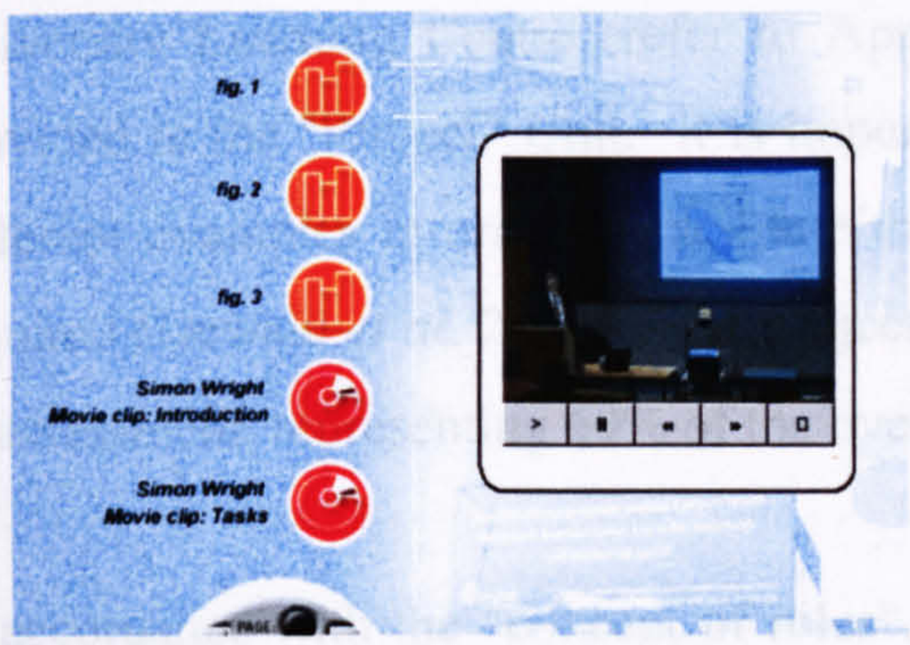


Figure 6.11 Planning and control interactive exercises

Whalley (1995) places emphasis on interactivity through the use of video. DIME[PM] employs what he describes as "fragmented video", using digital controls and QuickTime VR panoramic tools to operate the media (refer to Figure 6.12 (a) and (b)). The size of the "window" in DIME[PM] is a compromise between clarity, transmission speed and file size.



(a) "Fragmented video";

(b) QuickTime VR panoramic movie

Figure 6.12 Video sequences

McAteer and Shaw (1998) caution against the use of video simply to show a speaker, believing that it may be less effective than the use of sound without a moving picture. Audio clips are featured extensively in DIME[PM] although narration is used solely to reinforce academic papers and only limited control is provided, allowing the user to stop speech at any time. In accordance with Lawless and Kulilowich's (1998) research, a "bells and whistles" environment is avoided in DIME[PM], thus reducing potential distraction for low domain knowledge students.

6.8 Project-based assessment and case studies

Tait (1997) believes that many learners tend to study strategically. It is, he states, an attitude that inhibits constructive learning. To counteract this approach and simulate exploratory learning "authentic" assignments are recommended in a "real-life" situation. Jarz *et al* (1997) believe that assignments of this nature motivate students who are seeking rational solutions to real problems and they also prevent learners from passively consuming information without critical reflection (Henze and Nejdl, 1998). However, Henze and Nejdl concede that a situational approach does not necessarily allow students to readily apply newly acquired learning in different contexts.

A project-based/case study approach is central to the design of the DIME[PM]. Three projects are provided for purposes of the summative assessment (refer to Figure 6.13) i.e. Kirkstall Brewery student residences, Ellis Cross Estate and Leeds Metropolitan University Learning Centre (refer to Appendix E), and two further case studies are provided in the "Project" Unit. It is important that educational programmes must offer different examples in order to facilitate the abstraction and transfer of learning that is required (Dewald *et al*, 2000). The project-based assignment is one of two components of assessment, representing 60% of the overall marks for the module[6].

In accordance with the "concept of roles", referred to by Jarz *et al* (1997), the student assumes the role of an external project management consultant, commissioned to submit an operational plan. It is a scenario that is common to all the case study assessment briefs in DIME[PM].

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[6] Students are also required to prepare a video presentation selected from a pre-set list of debate motions. The topics, accessible via the web, are wide ranging and reflect the content within DIME[PM].

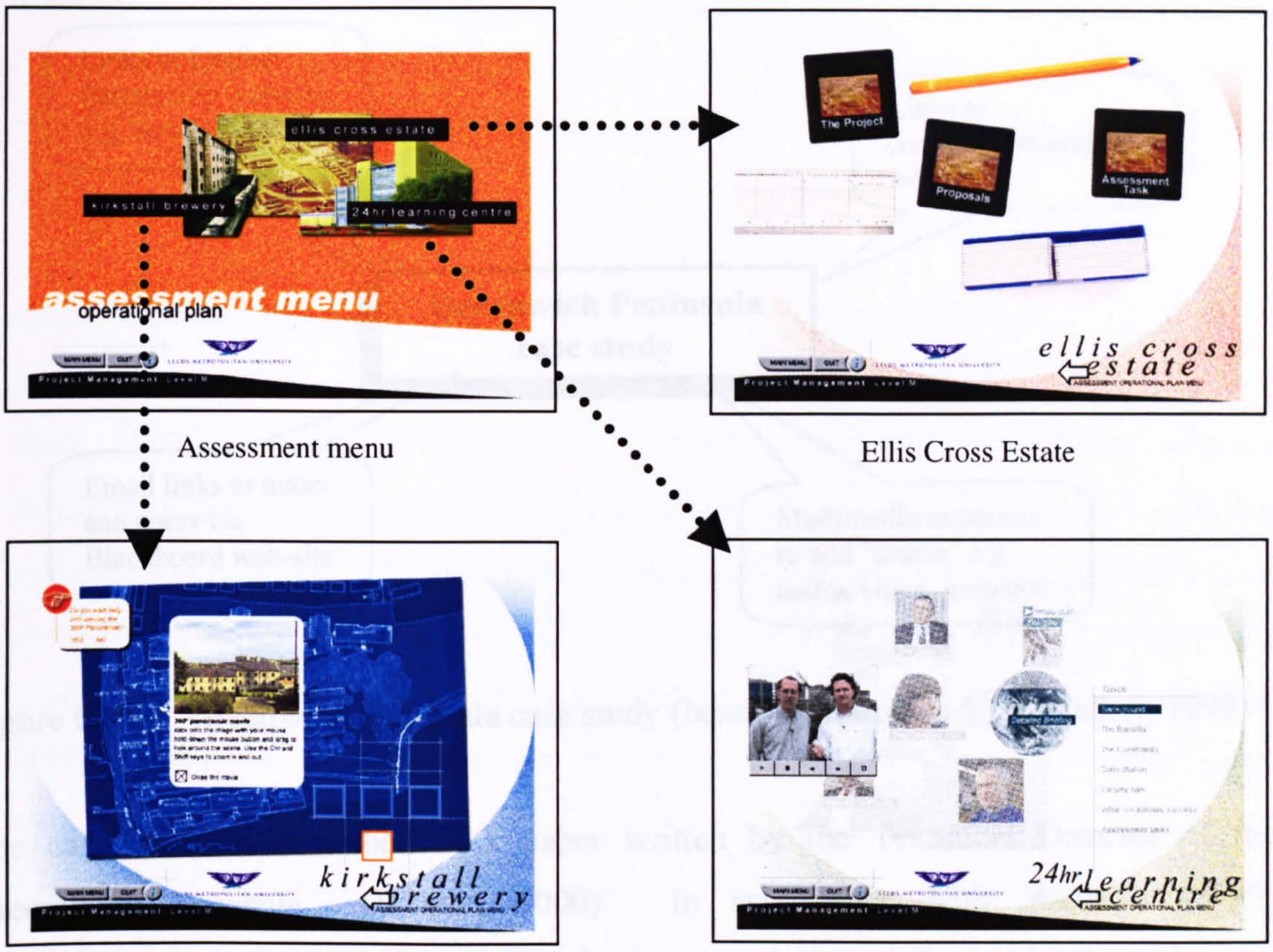


Figure 6.13 Project-based assessment

The user interface, however, varies for each assessment. For example, the "24 Hour Learning Centre" provides text, video and audio information, accessible via a series of content headings and is presented in a series of "bite-sized" formats. "Ellis-Cross Estate" utilises a slide collection metaphor and "Kirkstall Brewery" focuses on a project blueprint.

Jarz *et al* (1997) argue that multimedia technology can improve the presentational quality of case study material and, via a combination of open consultation and guided navigation, reduce the theoretical divide between behaviourist and constructivist approaches to learning. Walker (1999) values the skills that are developed through critical analysis of case studies and seeks to draw on the Internet for developing project management research studies. The model he adopts is replicated in DIME^{PM} in a case study of the Greenwich Peninsula re-mediation project (refer to Figure 6.14).

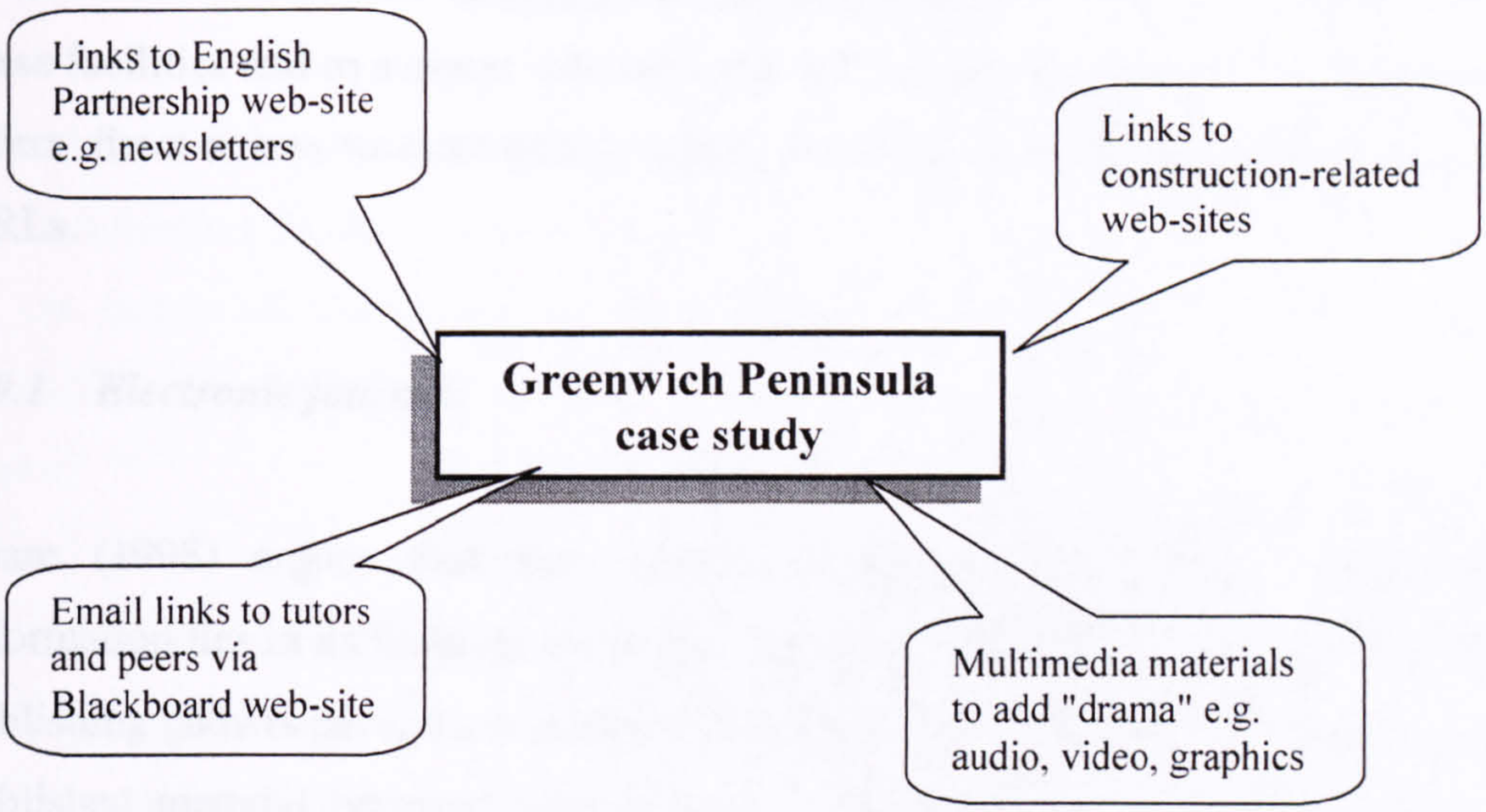


Figure 6.14 Greenwich Peninsula case study (based on framework by Walker, 1999)

The case study is described in a paper written by the Technical Director of the Greenwich Peninsula (Wright, 2000). In accordance with Walker's (1999) recommendations, audio and video clips from a guest lecture delivered by the author are also used to reinforce the narrative. Additional photographs of the site complement the graphics that appear in the original article and a panoramic scene further enhances the interactivity of the case study.

A link to English Partnerships' web-site, featuring Greenwich Peninsula newsletters, provides current project information and URLs, accessed via Blackboard, make further general reading available to the user. Unlike Walker's case studies, however, both the narrative and multimedia clips are contained on a CD-ROM. Walker (1999) acknowledges the technical difficulties associated with web-based video - problems experienced during the DIME^{PM} development process (refer to Section 7.6)

6.9 Virtual learning environments

Although most educators acknowledge that no one technology can deliver every type of learning experience (Dewald *et al*, 2000) the importance of web-based delivery of CAL is stressed by many respondents in the preceding chapter. It is a view that receives support from Tucker (1997). Fritz (1997) states that CAL must incorporate the strengths of real-time web based communication, if it is to be a viable teaching method.

Blackboard Course Info (http://www.blackboard.com) is used in DIME[PM] to provide these facilities and to support data retrieval and on-line assessment. In addition, the site offers direct access to electronic journals, text-only downloads and lists recommended URLs.

6.9.1 Electronic journals

Teare (1998) argues that the inherent weakness of CD-ROM based electronic information lies in its inability to access "real-time" information. Certainly as electronic publishing gathers pace, the benefits of linking to on-line libraries of current and archive published material become more evident. Accordingly, Blackboard provides direct links to a wide range of on-line journal data-bases e.g. Catchword, Emerald, Ideal and EBSCO, via the Leeds Metropolitan University web-site, together with the company's own educational resource centre. Off campus students are automatically registered to ATHENS i.e. a user authentication and authorisation service that provides IDs and passwords to access multiple resources (refer to Figure 6.15).

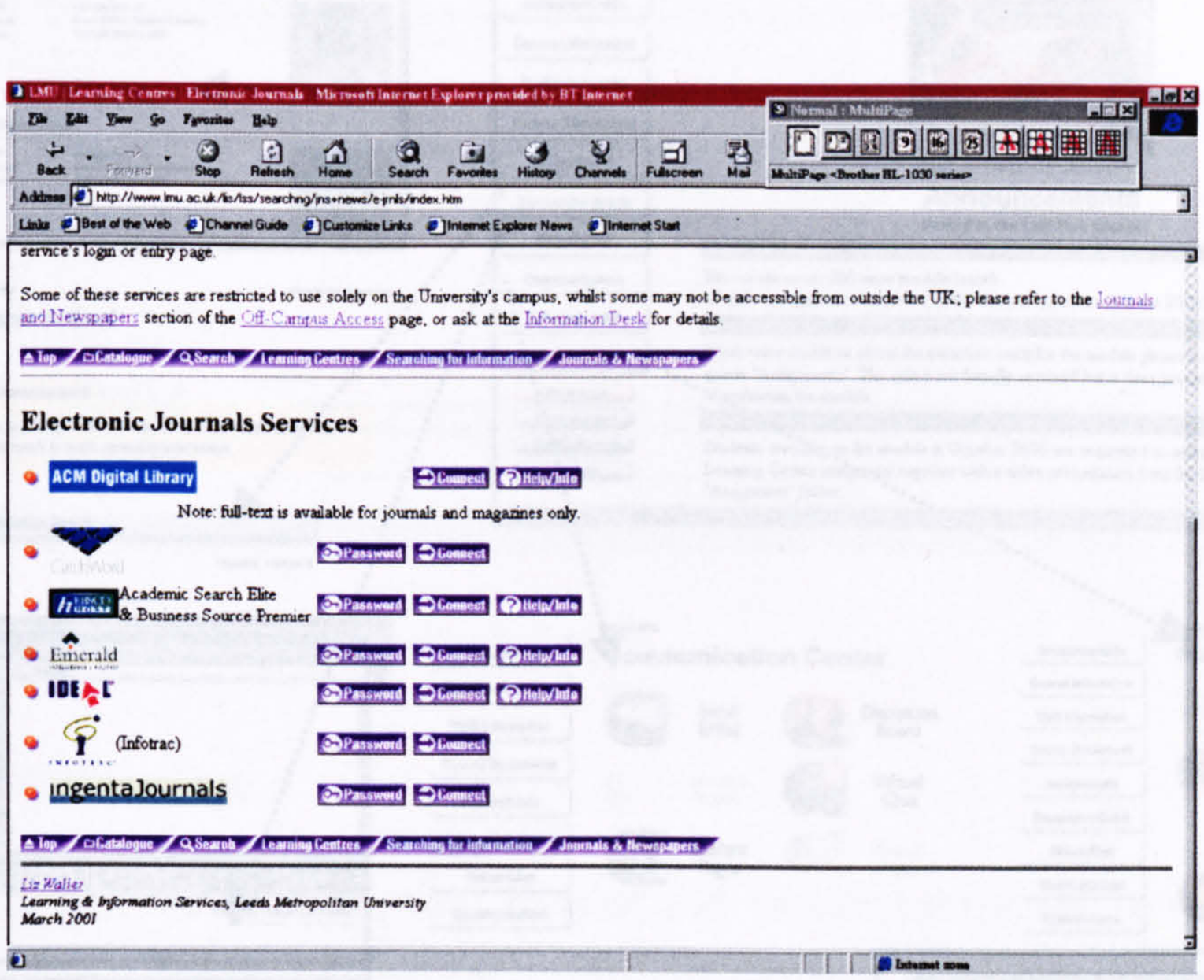


Figure 6.15 Electronic journals available on-line via Blackboard and the LMU web-site

6.9.2 Communication

Blackboard offers students a range of synchronous i.e. real-time, and asynchronous communication facilities (refer to Figure 6.16). As students undertaking DIME^{PM} may in the future be variously located around the world, asynchronous communication provided an opportunity to alleviate some of the constraints imposed by differing time zones.

Synchronous communication tools include Virtual Chat and Virtual Whiteboard facilities, which allow real-time chat and drawing capabilities. The email system provides students with ready access to the email addresses of their peers currently enrolled on the Blackboard course. Furthermore interaction is enhanced between tutors and students by asynchronous discussion boards and document sharing.

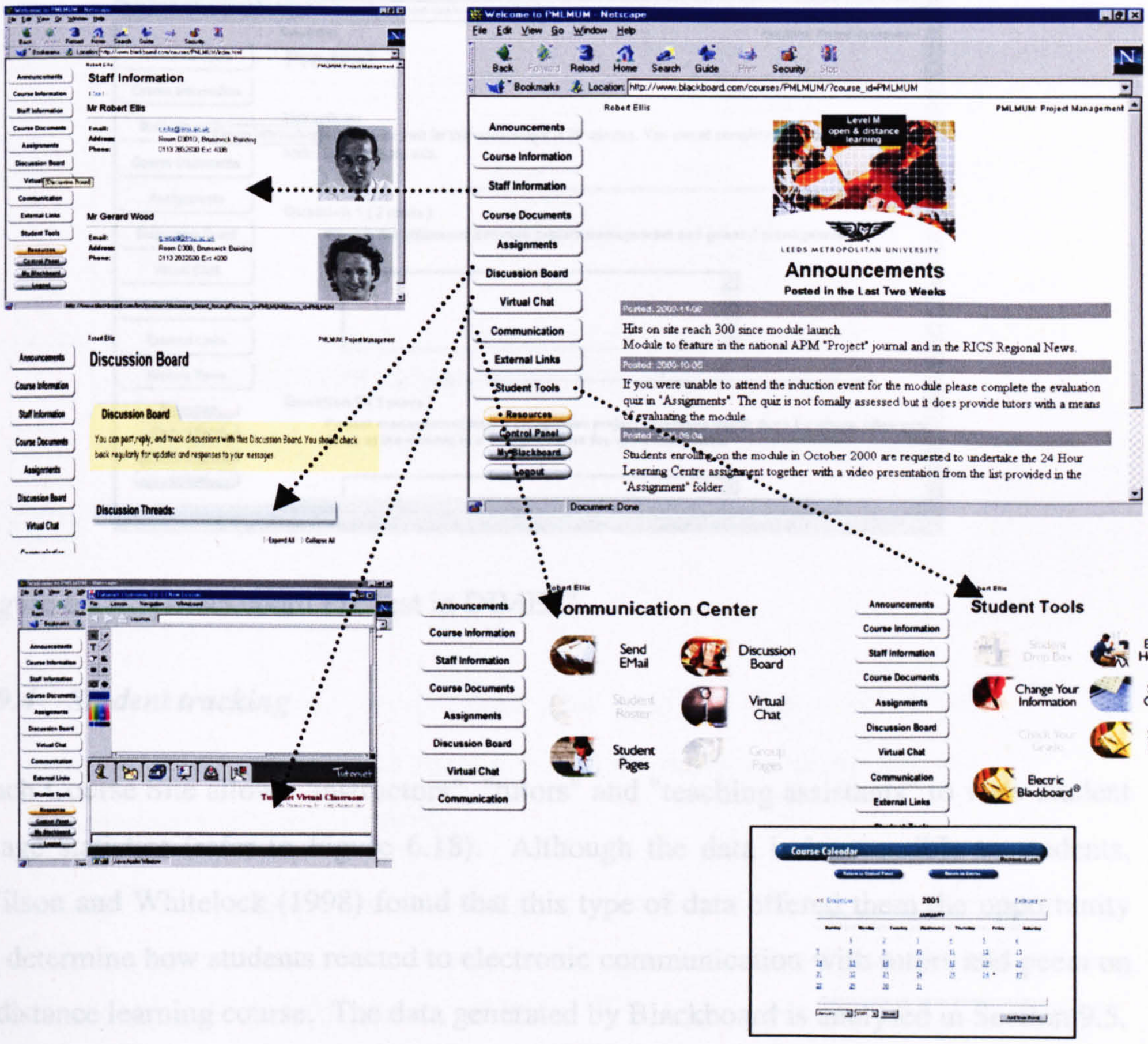


Figure 6.16 Communication facilities in Blackboard

Unlike the resources elsewhere in DIME[PM], there is only limited scope to alter the structural or screen design features of the VLE[7].

6.9.3 On-line assessment

The Instructor Control Panel creates all on-line assessments in Blackboard. The step-by-step process offers a variety of question types i.e. multiple choice, multiple correct, true/false, matching, ordering, short answer, fill in the blank and essay (refer to Figure 6.17). Attachments to questions, question randomisation, password-protection and timed tests are also possible. However, extensive use is not made of these facilities in DIME[PM]. Rather, the assessments are optional tests available to students who are unable to attend the induction workshop.

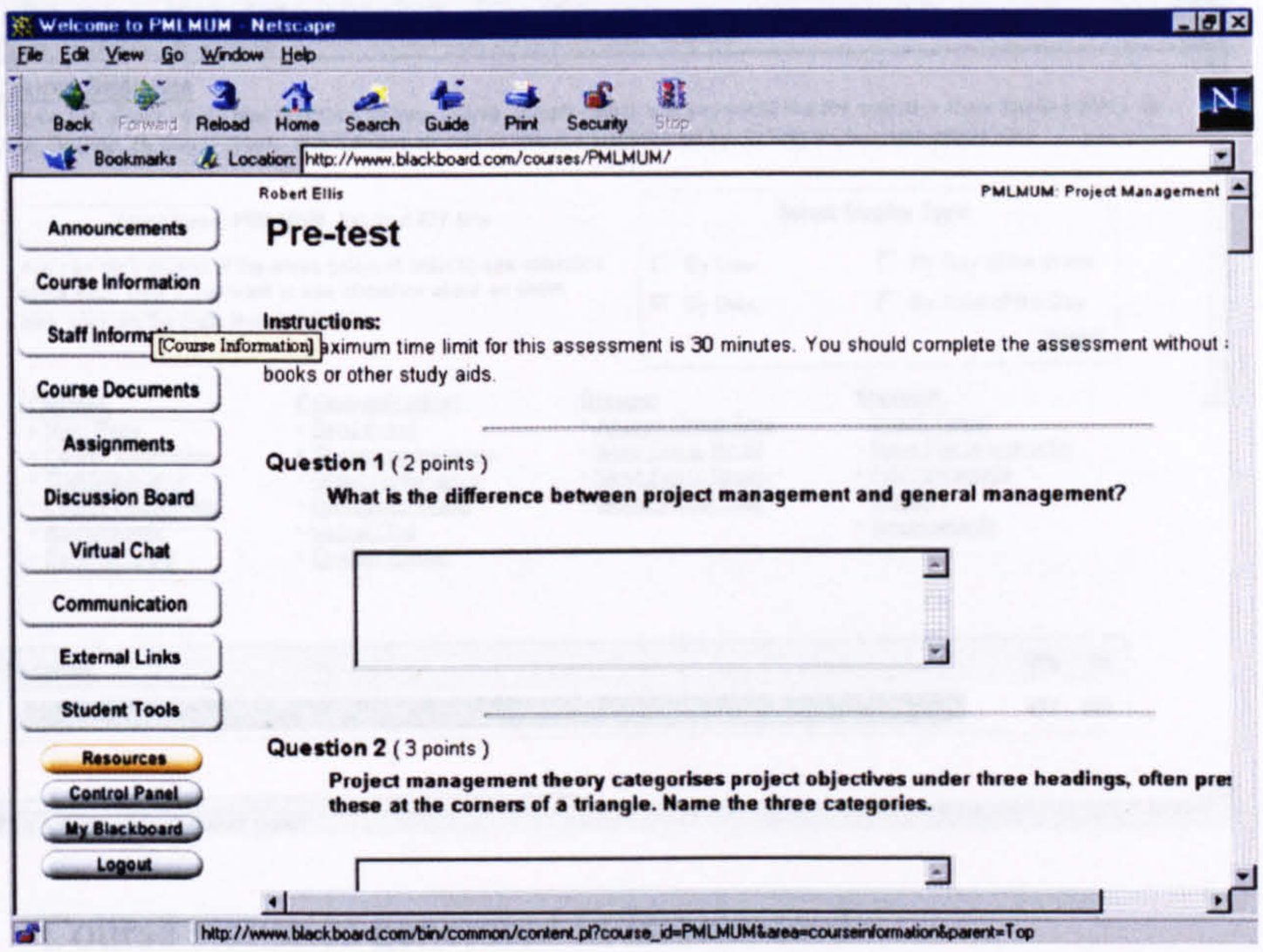


Figure 6.17 Blackboard Pre-test in DIME[PM]

6.9.4 Student tracking

Each Course Site allows "instructors", "tutors" and "teaching assistants" to view student usage statistics (refer to Figure 6.18). Although the data is inaccessible to students, Wilson and Whitelock (1998) found that this type of data offered them the opportunity to determine how students reacted to electronic communication with tutors and peers on a distance learning course. The data generated by Blackboard is analysed in Section 9.5.

[7] To gain student access to the Blackboard web-site enter the user name "external1" and password "exex".

6.10 Summary

The formative stages of Driscoll's (1998) developmental model provide a useful framework for the creation of an interactive multimedia educational programme. Emphasis is placed on process and the iterative nature of design. Without sufficient attention being given to instructional design and multimedia development, comparisons with other well established delivery modes would be meaningless. DIME^{PM} took cognisance of good practice design guidelines at a macrodesign and microdesign (Jarz *et al* (1997) and received peer recognition at Leeds Metropolitan University, winning a Chancellor's Award in the category Innovation in Teaching and Learning, in September 2000.

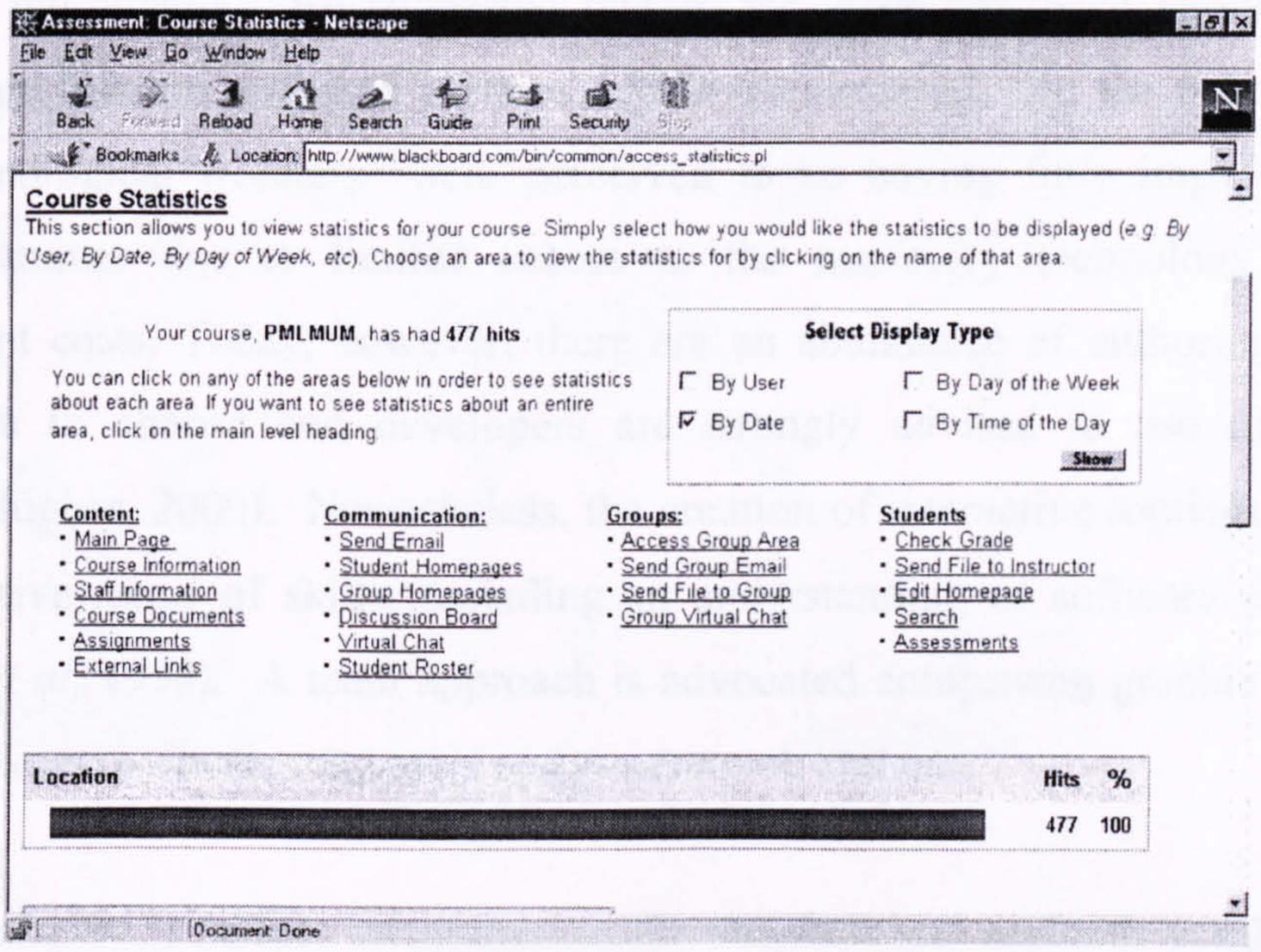


Figure 6.18 Course statistics generated in Blackboard

However, Hughes (2000) states that:

> *The test of a successful project is that your head fills with more and yet more great ideas that would make it better and better - and you can see exactly how you would do them.*

"Good enough", he continues, can be quite good enough. Following a discussion of the CAL authoring procedures at microdesign level (refer to Chapter 7) an analysis of the phrase "good enough" in the context of DIME^{PM} is undertaken in a bespoke hybrid evaluation.

Chapter 7

Integration and implementation of computer-aided learning from an authoring perspective

7.1 Introduction

A decade ago Tucker (1990) sought to distinguish computer-based training from interactive multimedia. He suggested that in the more advanced applications the learner could interact with and perhaps add to the material. At the time, however, such "technological wonders" were perceived to be having little impact upon the "average" trainer due to limited access to the necessary technology and high development costs. Today, however, there are an abundance of authoring packages from which to choose and developers are strongly advised to use off-the-shelf software (Hughes, 2000). Nevertheless, the creation of interactive routines requires a comprehensive range of skills, including an understanding of software engineering (Stefanov *et al,* 1998). A team approach is advocated comprising graphic designers, video producers, software engineers and coursework authors.

Benyon *et al* (1997) defines integration as the seamless and aesthetic combination of structure and presentation. This chapter explores the technical issues associated with the integration of different forms of media in Authorware 5.1 Attain (Macromedia). Interactive media, user control and the scripting of interactive exercises are discussed together with the problems of converting authored pieces into web-packaged applications.

The packaged version of DIME^{PM} and all Authorware files (available on the Program Disk) are attached to the back cover of this thesis.

7.2 Integrating media within an authored piece

Fisher (1994) states that multimedia is essential when the resource being developed seeks to benefit from a combination of audio and video with text and graphics. DIME^{PM} draws together a wide variety of educational resources developed over a five-year period i.e. since the launch of the Project Management module (refer to Figure 7.1). These are integrated on a hybrid CD-ROM together with a comprehensive range of user functions in accordance with the multimedia design imperatives discussed in Chapter 6.

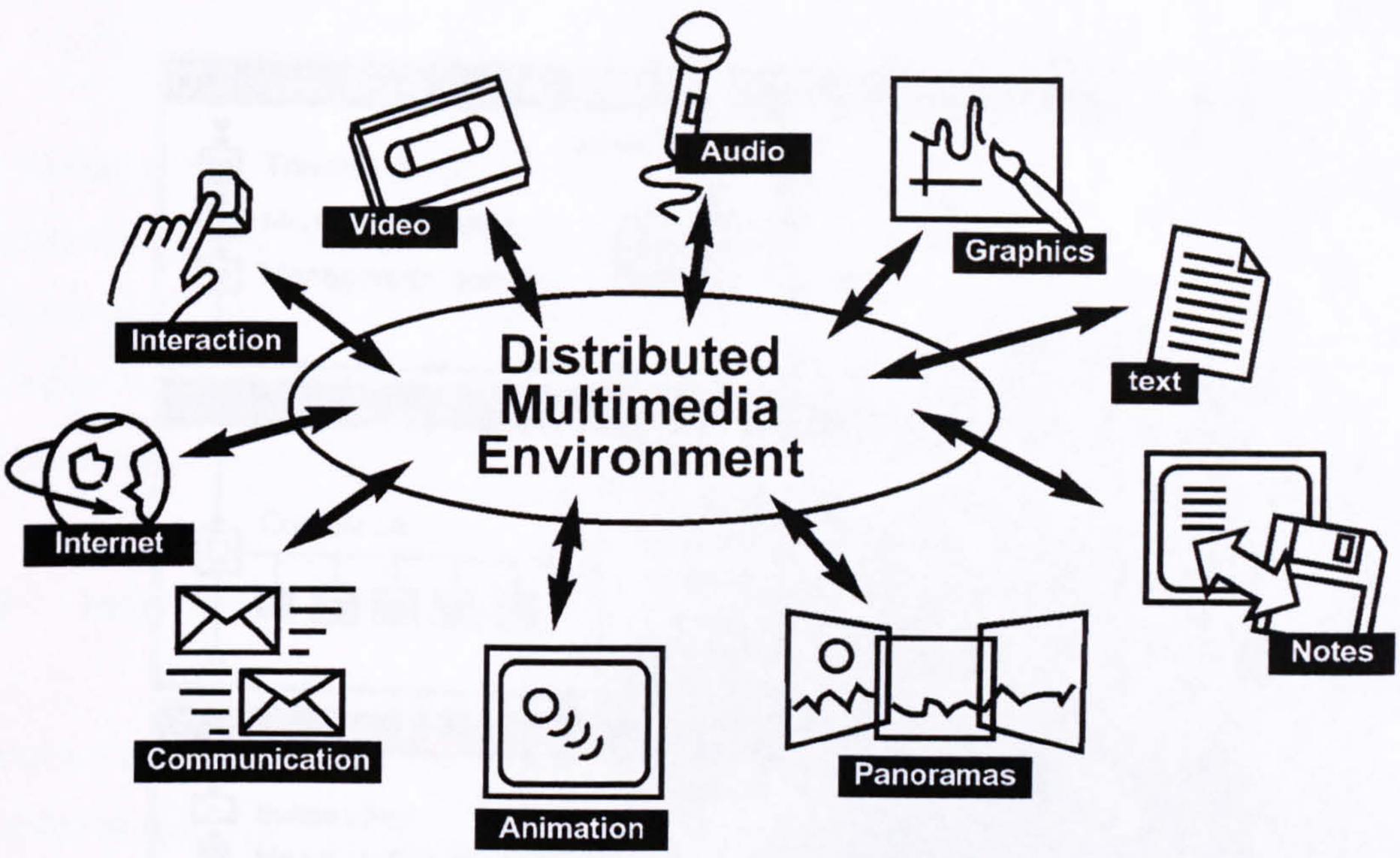


Figure 7.1 Functionality of DIME^{PM}

The framework for DIME^{PM} is constructed using Macromedia Authorware 5.1 Attain. This high level system adopts an icon-based authoring approach. Icons are placed on a flow-line that determines the sequence in which the piece runs (refer to Figure 7.2). The type of icons used, therefore, determines the functionality of different media objects. Content in DIME^{PM} is divided into a series of modules, described by Fisher (1994) as blocks of information or basic units of documentation.

Macromedia (1998) recommends that each piece is divided into several parts and that plans to make a piece modular must be well advanced prior to authoring taking place. Certainly pre-planning is vital to the success of multimedia developments (Harrison, 1994). In DIME^{PM} duplication of effort was minimised by strict adherence to standard design protocols e.g. libraries for managing the content stored in icons. In this way content could be re-used, enabling it to be up-dated and maintained after each module was completed. Each module in DIME^{PM} corresponds to the "Content" Topics (refer to Section 6.3) and each Learning Point contains links to location overviews and notes pages.

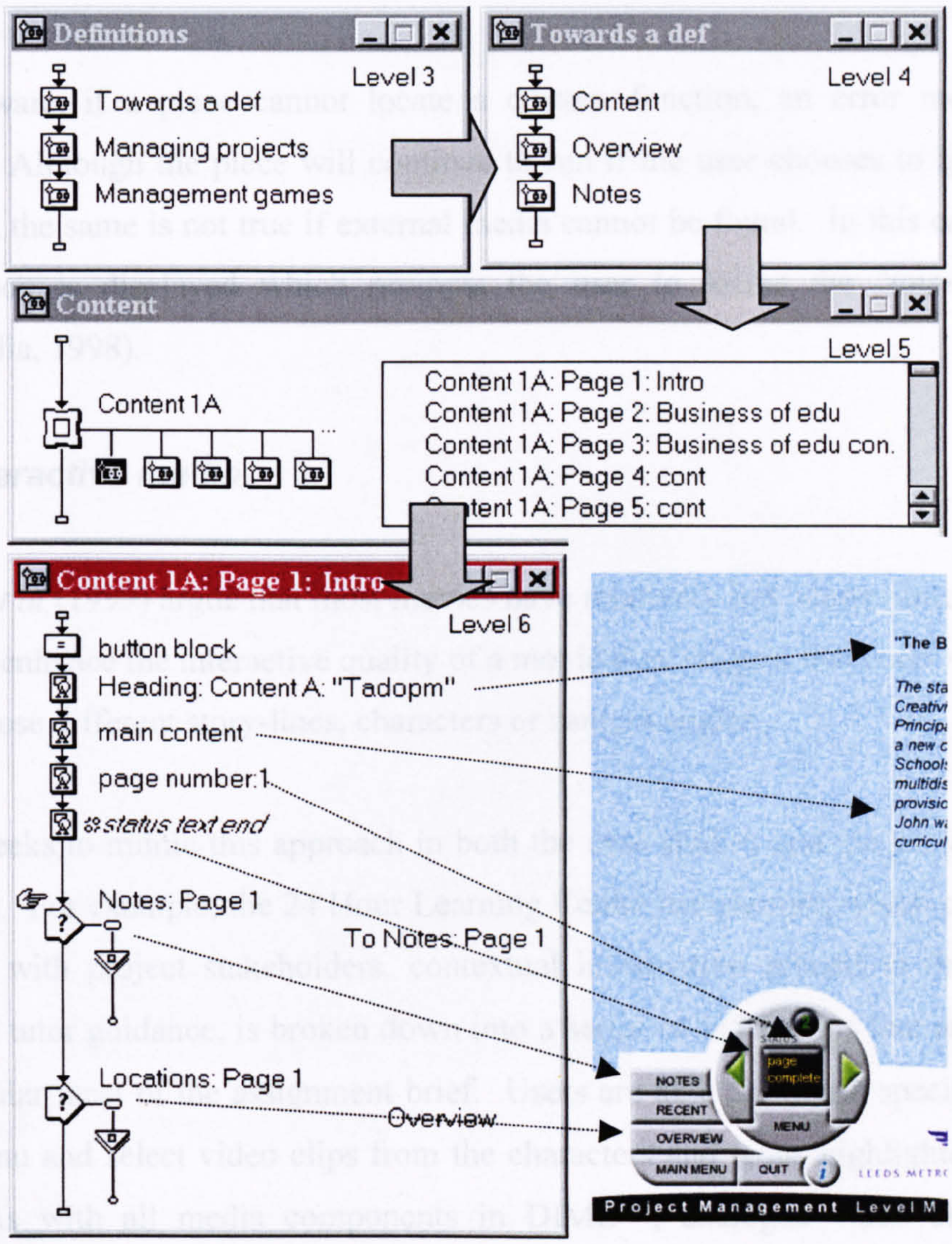


Figure 7.2 Management of content within DIME^{PM}

In addition to "module" files, authored pieces also require Xtras to process the specified graphic or sound formats, scripting Xtras and DLLs (i.e.Windows dynamic link libraries). Because files for DLLs are separate from the files that call them, they must be in the folders specified in the search path (Macromedia, 1998). As the computers running authored packages seldom have the same folder structure as the platform on which the piece is created, it is necessary to provide a search path to locate an external file. Early problems locating external files in DIME^{PM} were resolved by incorporating the SearchPath system variable at the start of the flowline:

```
SearchPath := ".\\externalcontent"
```

In Authorware, if a piece cannot locate a custom function, an error message is displayed. Although the piece will continue to run if the user chooses to ignore the instruction, the same is not true if external media cannot be found. In this case a File dialogue box is displayed which prompts the user to locate the "missing" file (Macromedia, 1998).

7.3 Interactive media

Rebelsky *et al* (1999) argue that most movies have relatively low viewer-interactivity. In order to enhance the interactive quality of a movie they suggest that users should be able to choose different story-lines, characters or camera angles.

DIME^{PM} seeks to mimic this approach in both the case studies and the project-based assessment. For example, the 24 Hour Learning Centre assignment, which comprises interviews with project stakeholders, contextual information related to the project setting and tutor guidance, is broken down into a series of video clips that are related to a particular facet of the assignment brief. Users are able to choose specific topics from a menu and select video clips from the characters and icons highlighted on the screen. As with all media components in DIME^{PM}, analogue video clips were converted from analogue to digital AVI format using Media 100 (refer to Figure 7.3) and Media Cleaner pro4 (http://www.terran.com) before resizing in Adobe Premiere (refer to Figure 7.4). Each file is inserted onto a flow-line in Authorware via the "Movie Controller" Knowledge Object.

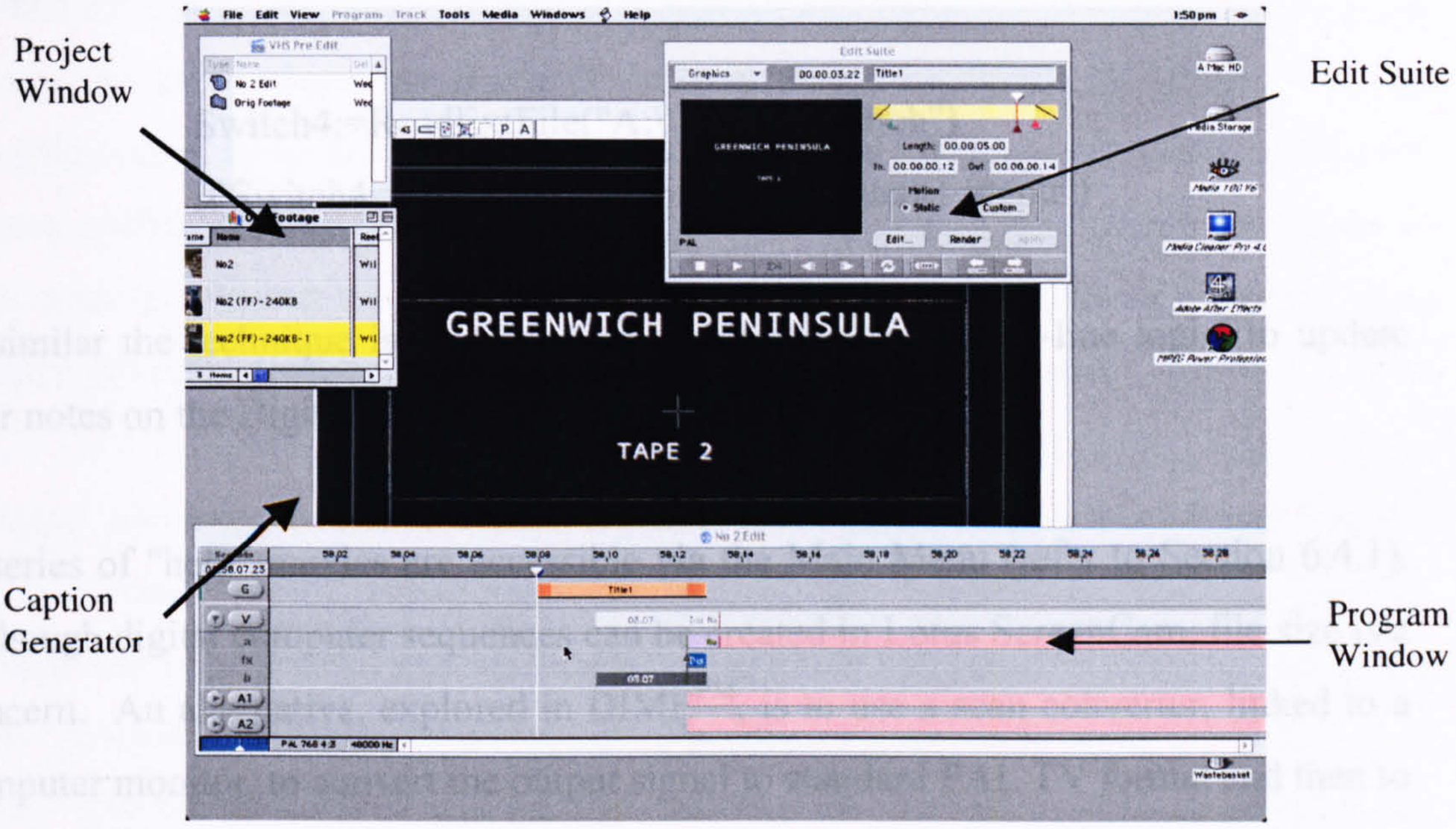


Figure 7.3 Conversion of analogue video to digital format in Media 100

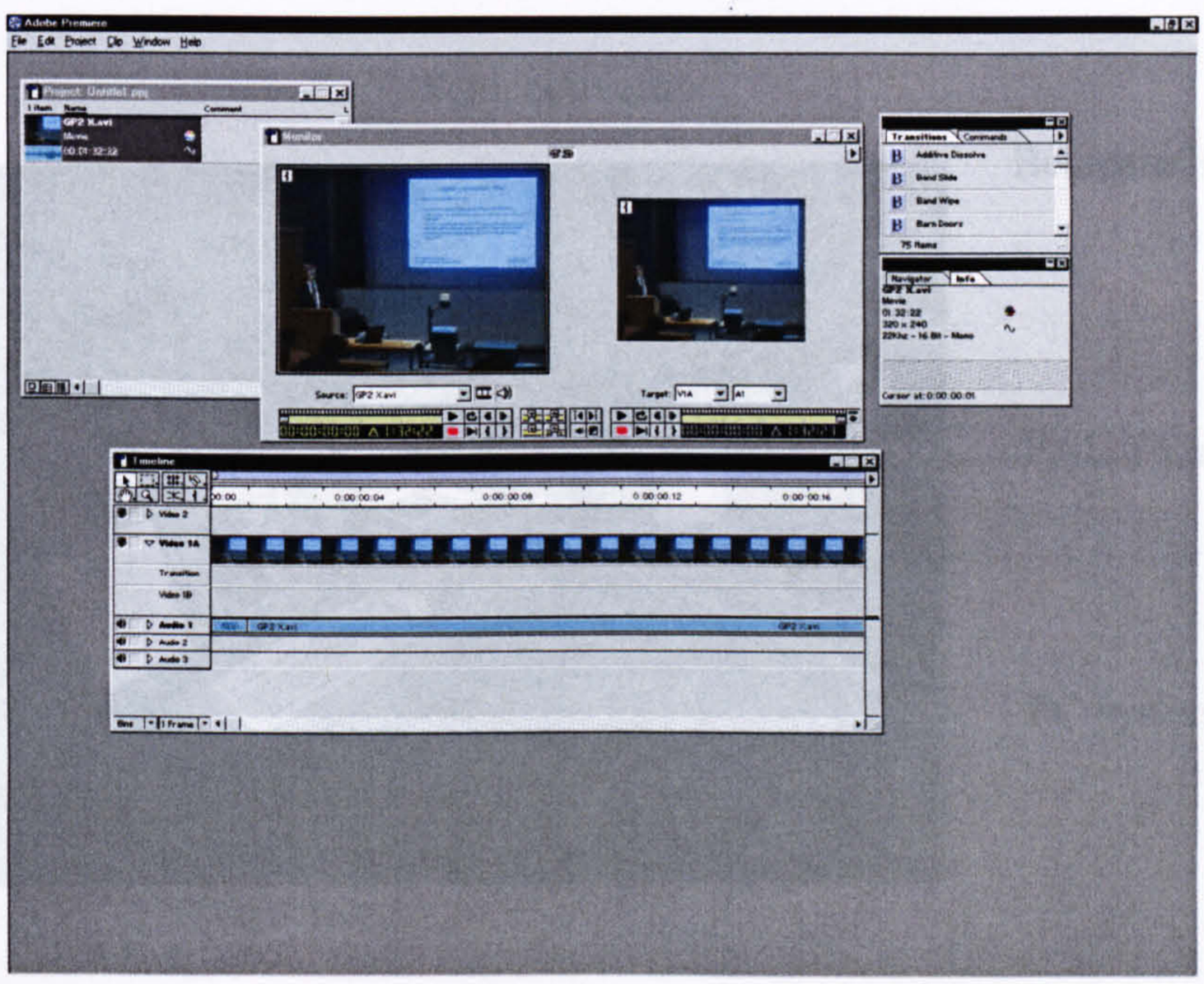


Figure 7.4 Resizing of movie in Adobe Premiere

DIME^{PM} also contains "tutor support movies" (refer to Section 6.4.2). Users are offered the opportunity to retain or remove these movies from the screen. This user-related preference is stored on a 3½" floppy disk. DIME^{PM} therefore uses the metaphor of the Personal Data Disk (KMPG, 1999) to personalise the learning resource.

Scripting in Authorware calculation icons enables "switching" variables on the disk to be updated:

```
Switch4:=ReadExtFile("A:\\Movie4Switch")
if Switch4=1 then GoTo(IconID@"Content1 menu")
```

A similar the technique is also used, in conjunction with flow-line logic, to update user notes on the Digital Notepad (refer to Section 7.4).

A series of "help" movies are accessible via the Main Menu (refer to Section 6.4.1). Although digital computer sequences can be created in Lotus ScreenCam, file size is a concern. An alternative, explored in DIME^{PM}, is to use a scan converter, linked to a computer monitor, to convert the output signal to standard PAL TV format and then to record the output on a Beta VTR (refer to Figure 7.5). Media 100 equipment enables the digital video and audio files to be mixed.

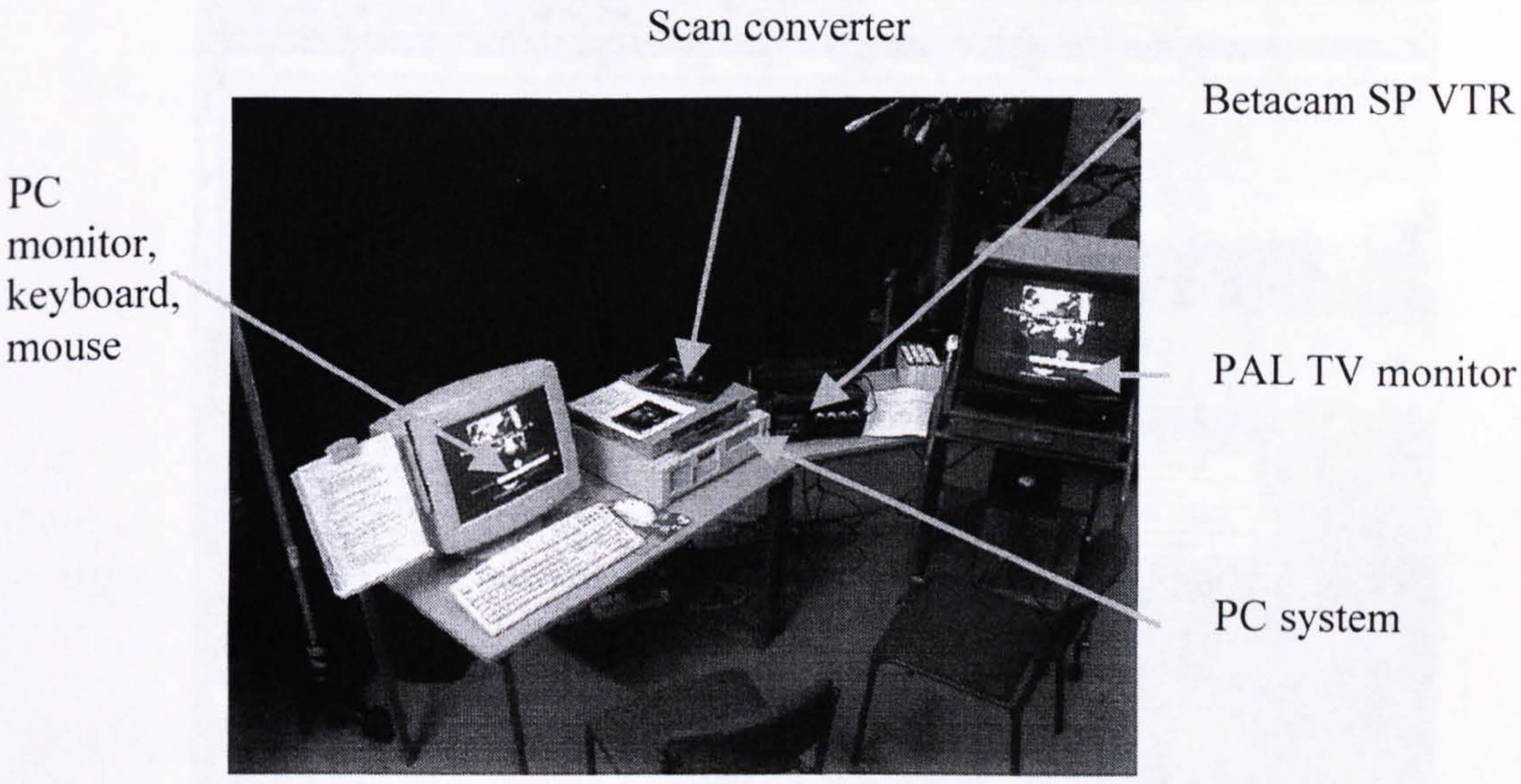


Figure 7.5 Conversion of "help" movies to digital AVI format

All video clips in DIME^{PM} are AVI files (Video for Windows), with a display at 320 x 240 pixels. Compression settings are Cinepak, millions of colours, spatial 50%, temporal 50%, 25 fps, keyframe every 15 and 260 Kb/sec video. Audio settings are 44.1 KB/sec, 16 bit mono sampled at 22.050 KHz.

Panoramic scenes or movies add further to the interactive nature of the environment. Users may view an image through 360 degrees and have the facility to zoom in and out of the scene. Software applications are available e.g. Apple QuickTime VR, that enable scenes to be linked to create a "virtual world" (Ellis *et al*, 1998). However, these applications require a relatively high specification Apple Macintosh computer and photographs that are taken at precise angles. Ellis *et al* (1998) outline a procedure which provides similar functionality for unlinked panoramic scenes.

Digital photographs are downloaded into Adobe Photoshop version 5 and inserted onto different "layers" within a new file, before being dragged into position. Once the image has been aligned and the brightness and contrast controls adjusted, the layers are "flattened" and the image cropped to produce a panoramic scene (refer to Figure 7.6). The image is saved as a PSD file and opened in Photoshop for the Macintosh, rotated 90 degrees clockwise and saved as a PICT file.

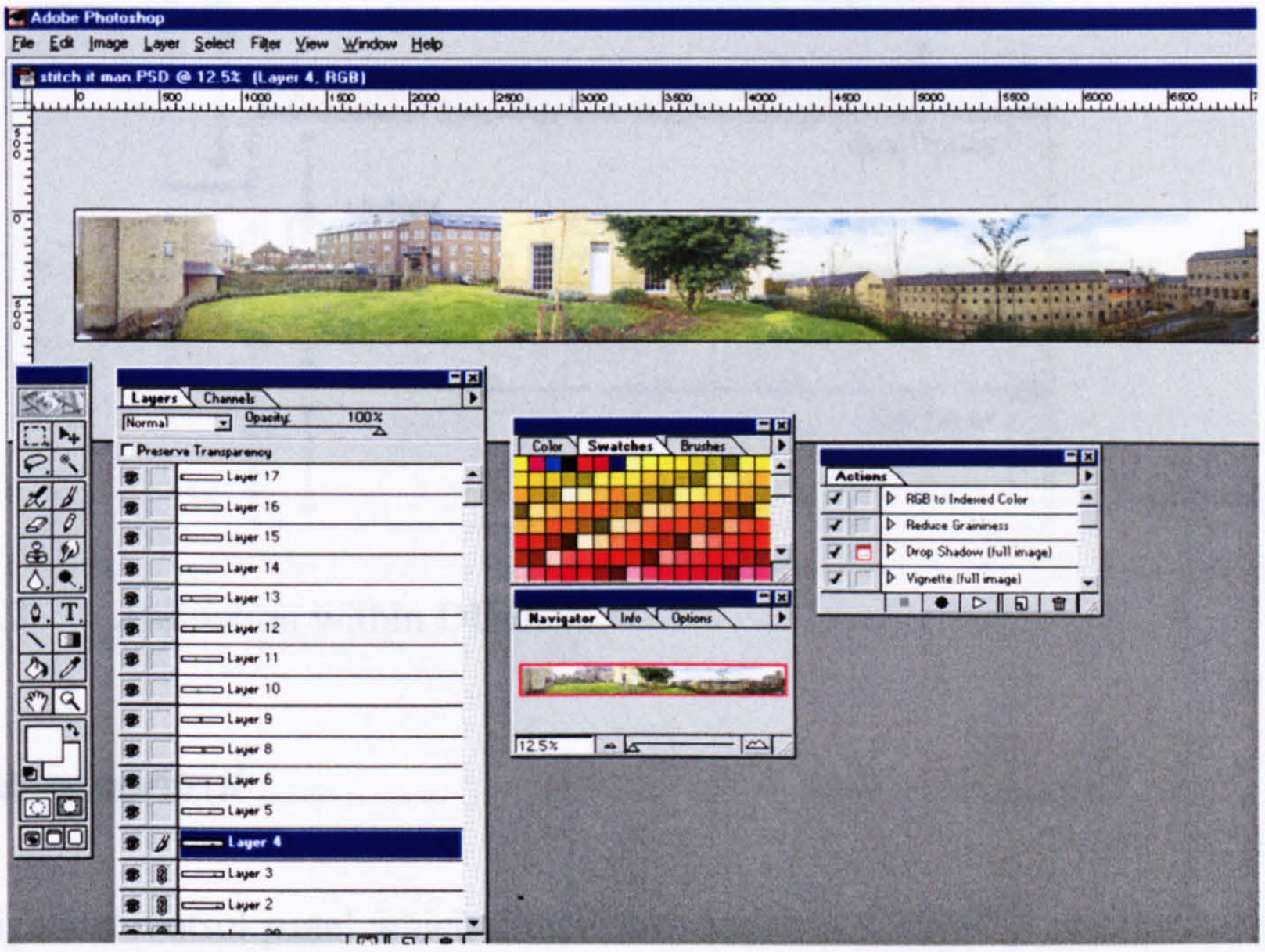


Figure 7.6 QuickTime VR Panoramic scene created and sewn together in Adobe Photoshop

The file is then opened in Make QuickTime VR Panorama and the ratio of the panoramic image size determined. Appropriate adjustments to the image size are made in Photoshop before re-launching the QuickTime software. Viewer size and magnification are specified prior to the software converting the image into a panorama movie (Ellis *et al*, 1998)

Animation provides another stimulus for the learner. DIME^{PM} uses animated GIF files to indicate when an audio file is operating and further control of the media is designed into the piece with an interaction icon to halt the file (refer to Figure 7.7).

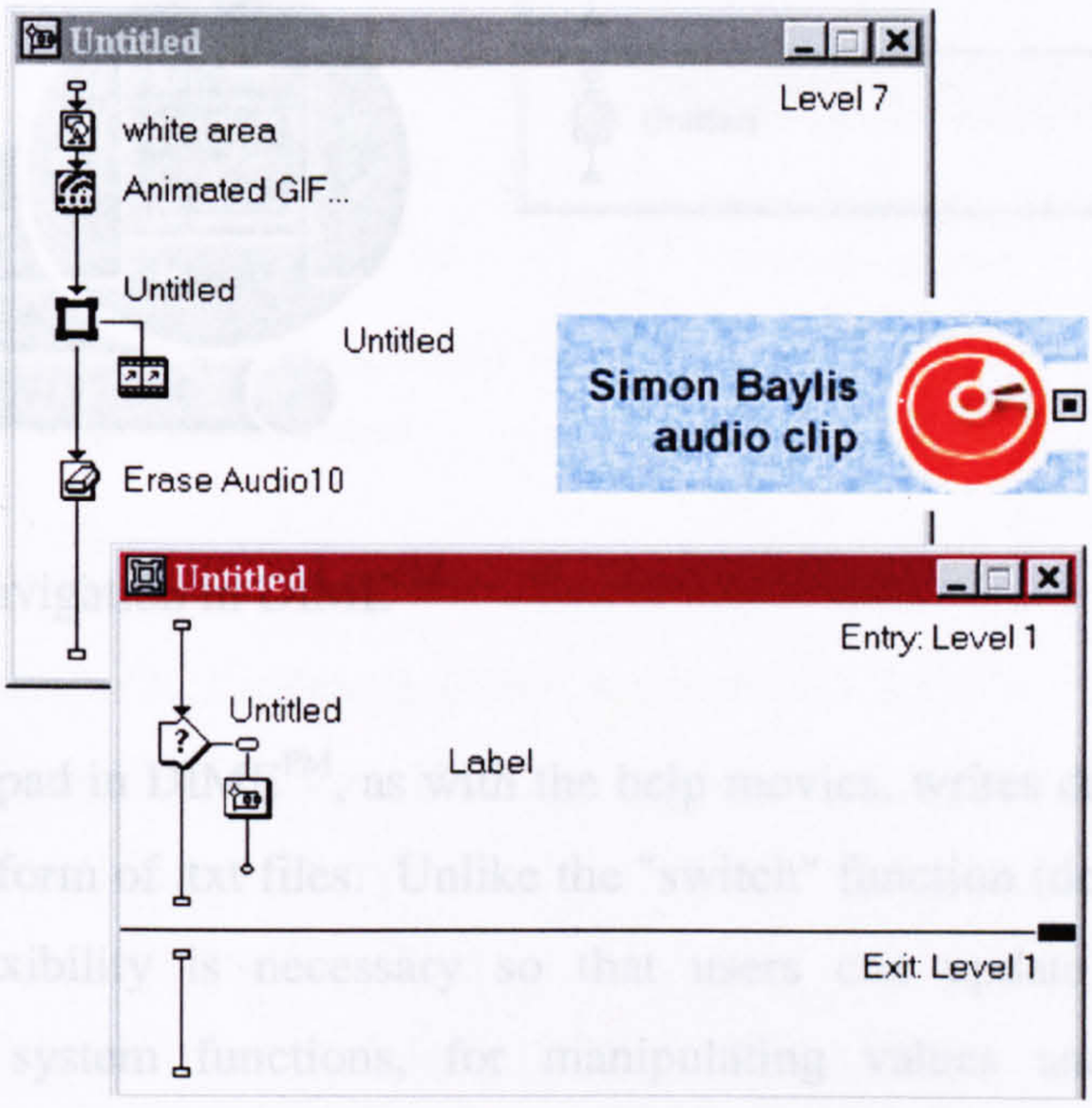


Figure 7.7 Animation within DIME^{PM}

7.4 User control

The navigation control panel which directs movement in DIME^{PM}, and allows users to trace progress and annotate individual screens, is controlled by a series of buttons located within Authorware's framework icons (refer to Figure 7.8). The flow-line uses Authorware's default settings, although the Notes facility is a bespoke feature.

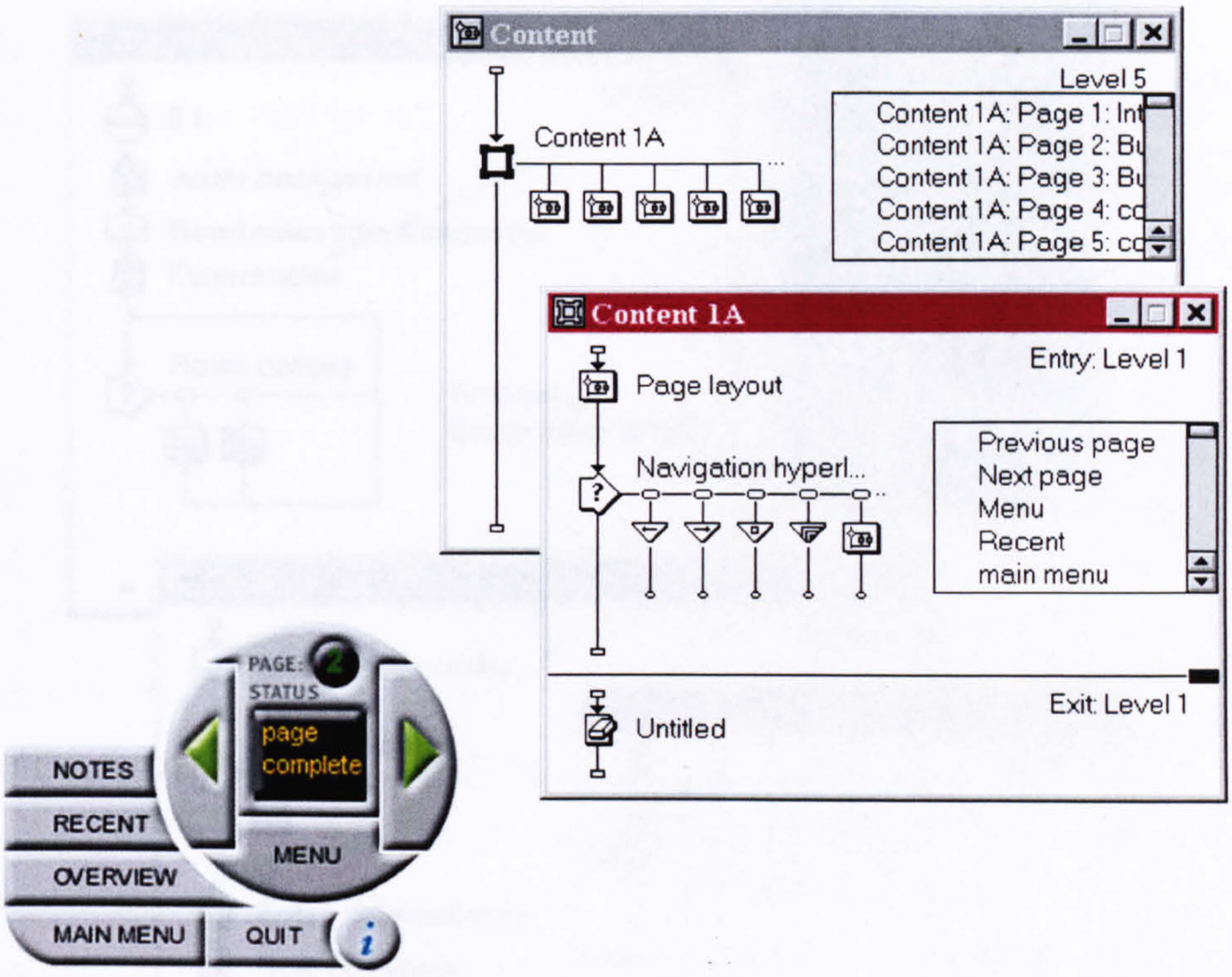


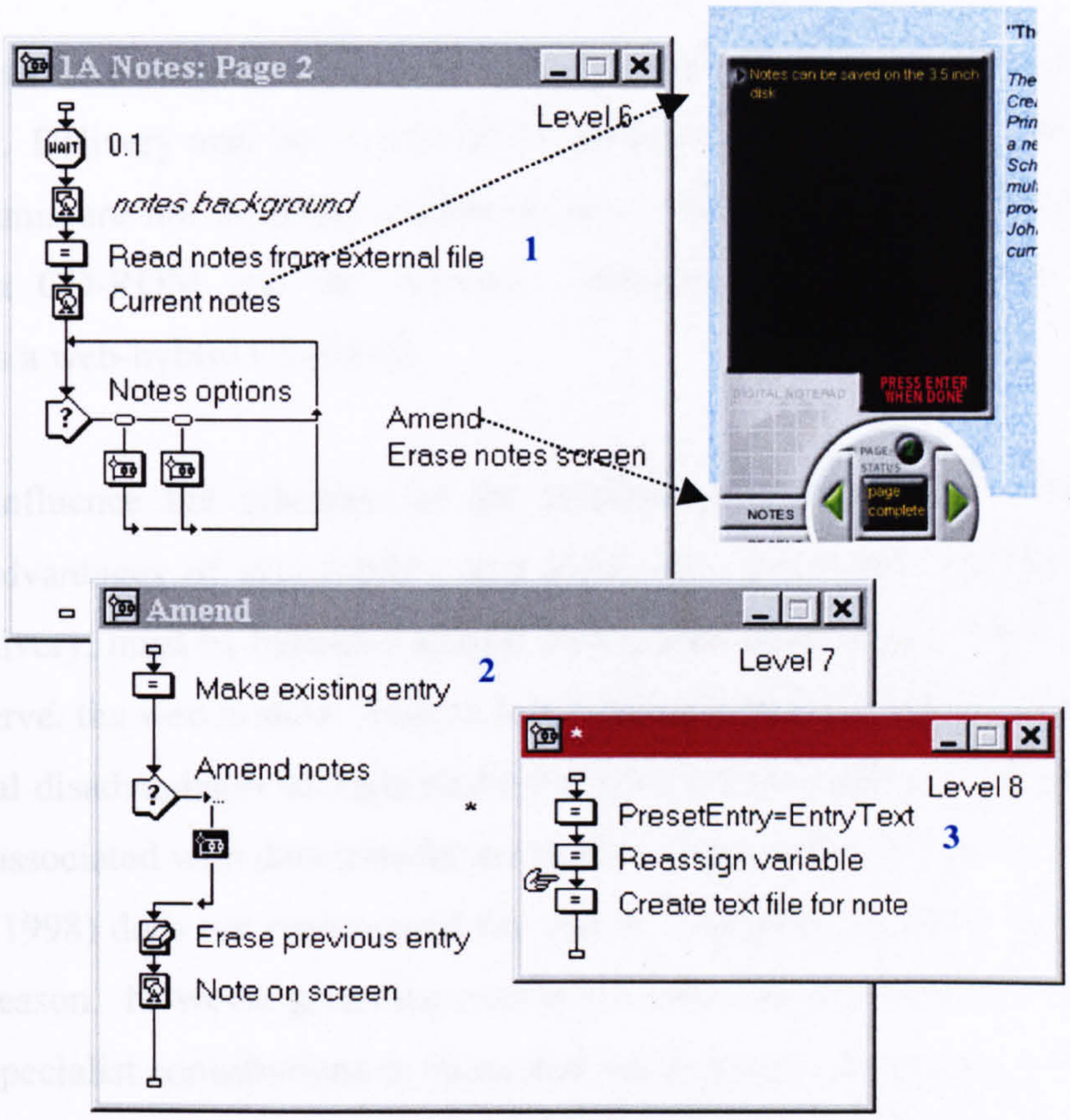
Figure 7.8 Navigation in DIME[PM]

The Digital Notepad in DIME[PM], as with the help movies, writes data to the Personal Data Disk in the form of .txt files. Unlike the "switch" function (described in Section 7.3), greater flexibility is necessary so that users can update annotations. A combination of system functions, for manipulating values and controlling the operation of the application, and flow-line programming enables all page entries to be amended by the user (refer to Figure 7.9).

7.5 User interaction

The need for interaction is referred to in Chapter 6. As the Authorware User Manual states:

> *If you do nothing more than present text, graphics, animation, video and sound to users, you're creating the equivalent of a television commercial ... it's a passive, one-way form of communication.*
>
> (Macromedia, 1998)



[1] Notes12C1:=ReadExtFile("A:\\Notes12C1.txt")

[2] PresetEntry:=Notes12C1

[3] PresetEntry:=EntryText

Notes12C1:=EntryText

WriteExtFile("A:\\Notes12C1.txt",Notes12C1)

Figure 7.9 "Digital Notepad" in DIME[PM] and flow-line programming

A wide variety of interactive functions and commands are used to create the formative exercises in DIME[PM]. Table 7.1 lists each activity and the "response type" symbols employed in the respective pieces. All files used in DIME[PM], prior to Authorware packaging, are contained on the Program Disk attached to the dissertation.

7.6 Distribution of CAL

The medium used to distribute multimedia resources impacts upon the structure of the authored piece. Delivery may be via CD-ROM, DVD or across a network. However, delivery mediums are not mutually exclusive, as in the case of DIME^{PM}, which is distributed via CD-ROM and the Internet. Macromedia (1998) refers to this combination as a web-hybrid CD-ROM.

Factors that influence the selection of the medium are identified in Chapter 6. Clearly, the advantages of accessibility and flexibility, commonly associated with web-based delivery, must be balanced against data transmission speed. As Benyon *et al* (1997) observe, the web is slow. Indeed bandwidth, as Mudge (1999) states, is one of the principal disadvantages of multimedia delivery via the Internet. He notes that the problems associated with data transfer are further compounded by the size of files. Macromedia (1998) does not recommend the use of "big graphics and lengthy files" for this very reason. However given the media-rich nature of the learning material in DIME^{PM} i.e. specialist contributions in video and audio format, it was not possible (or desirable) to substitute these inputs with transcripts from the relevant lectures.

Performance testing of a web-based version of DIME^{PM} confirmed the view that download times of media rich applications can be excessive. The web-packaged piece was pulled into a web page (refer to Figure 7.10) and run using Netscape Navigator[1]. The pilot application i.e. the Greenwich Peninsula case study, although successfully converted into a web-based format using Authorware Web Packager took approximately 15 minutes to download on the Internet. Download times on the University Intranet were significantly quicker (approximately 1 minute). The application creates separate map files for all Authorware files and their associated library files (Macromedia, 1998). Regardless of the size (default 16K) of the specified segments, however, the external files e.g. video and audio files, are not divided. Furthermore, in-compatibility issues associated with various web-browsers, a concern noted by Benyon *et al* (1997), and the limited space available on institutional servers at Leeds Metropolitan University, created additional practical problems.

[1] http://www.lmu.ac.uk/hen/benv/pmlm

Location	Activity	Interactions
Project Perspectives	Mind map[2]	Button, Hot spot, hot object, knowledge object "URL"
	Learning styles questionnaire[2]	Button, hot object, hot spot, script
	Management task force	Button, hot object, text entry, time limit
	Management style	Button, knowledge object "Slider", hot object, script, motion
	Consultation	Button
	Client brief	Button, hot spot, hot object, script, text entry
Tools and techniques	Work breakdown structures	Button, hot object, script
	Critical path analysis no.1[2]	Button, hot object, target area, number entry
	Ditto no.2[2]	Button, hot object, number entry
	Ditto no.3[2]	Button, hot object, number entry
	Needs analysis	Button, hot object, text entry, script
	Functional analysis[2]	Button, hot object, target area
	FAST[2]	Button, hot object, target area
	Verb-noun	Button
	Value management[2]	Button
	Lottery	Button, conditional, text entry, number entry, script, motion, decision path, hot object
	Project risks	Button, hot object, text entry, script
	Decision tree	Button, hot object
	Validity and reliability	Button, hot object
Interpersonal skills	Background awareness[2]	Button, text entry, script
	Context	Button, text entry, script
	Communication	Button, hot object, text entry, script
	Barriers to communication	Button, text entry, script
	Self-awareness	Button, text entry, script
	Observation and listening	Button, text entry, script
	Confidence	Button, hot spot
	Influencing skills	Button
	Negotiation styles[2]	Button, target area
	Motivation	Button, target area, script
	Team dynamics[2]	Button, hot object, hot spot, script, motion
	Office communications	Button, hot object

Table 7.1 Types of interaction used in DIME^{PM}

In order to future proof DIME^{PM} and retain flexibility, each component i.e. Content, Assessment, About and Connect, is authored in self-contained files, and linked to a central Main Menu file. Likewise, all the interactive exercises listed in Table 7.1 are independent Authorware files, launched directly from the Content screen pages. The majority of the learning materials are stored on CD-ROM, and only regularly up-dated information e.g. debates topics and assessment briefs, made accessible on the Web.

[2] Principal authors of scripts: I. Dickinson and A. Bowman, Capability Learning Support Unit, LMU

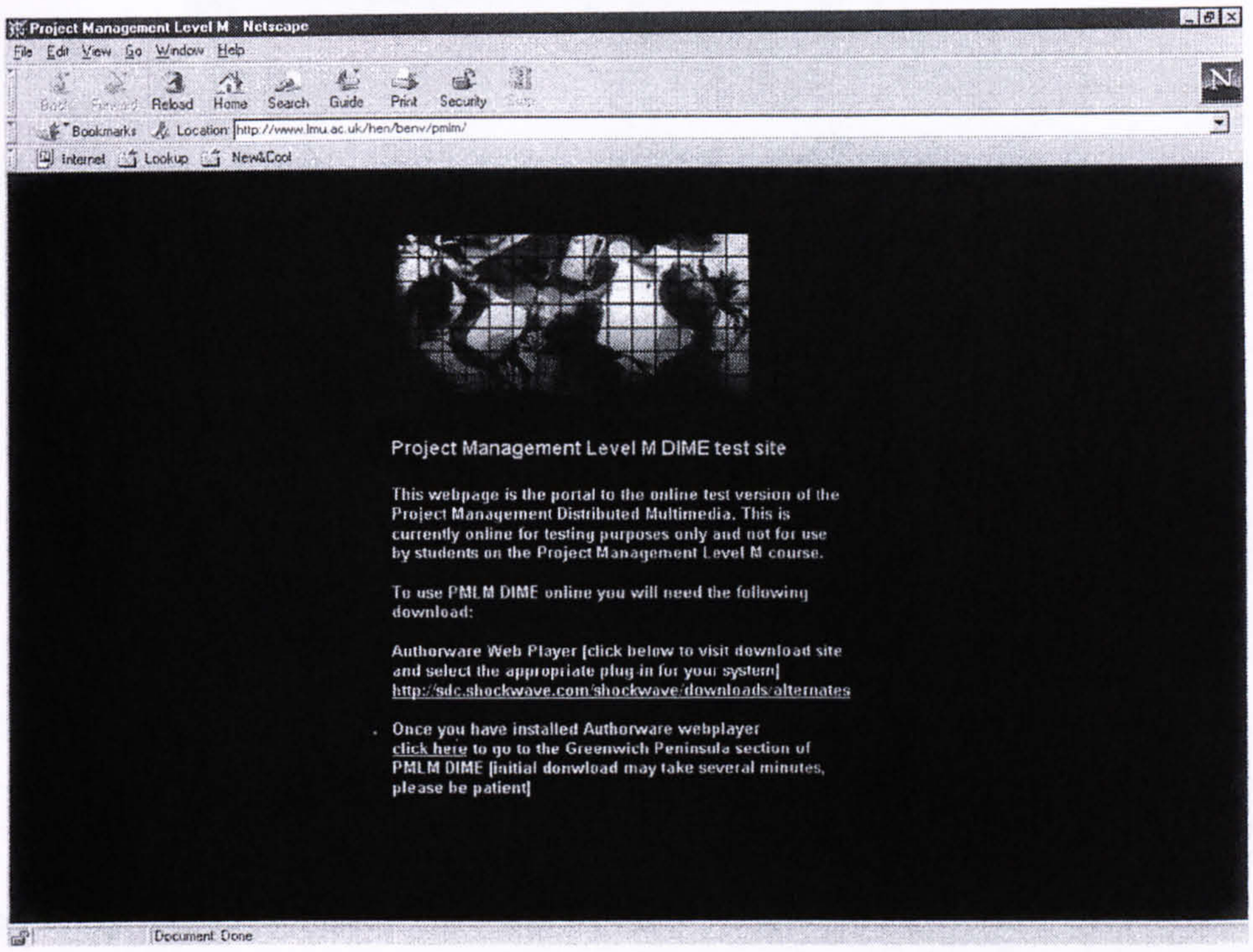


Figure 7.10 Web access to Greenwich Peninsula case study[3]

A seamless interface between the CD-ROM and the Internet is an important feature of DIME[PM] as it facilitates communication between the tutor and student (Neilson and Thomas, 1996) and ensures that the hybrid learning resource retains internal consistency. Knowledge Objects i.e. pre-written Authorware pieces, provide an interface for launching the specified URL within the system's default web browser (refer to Figure 7.11). Users are able to click on appropriate links and gain immediate access to pre-defined URLs.

[3] html code written by Adrian Riley, Capability Learning Support Unit, Faculty of Health and Environment, LMU

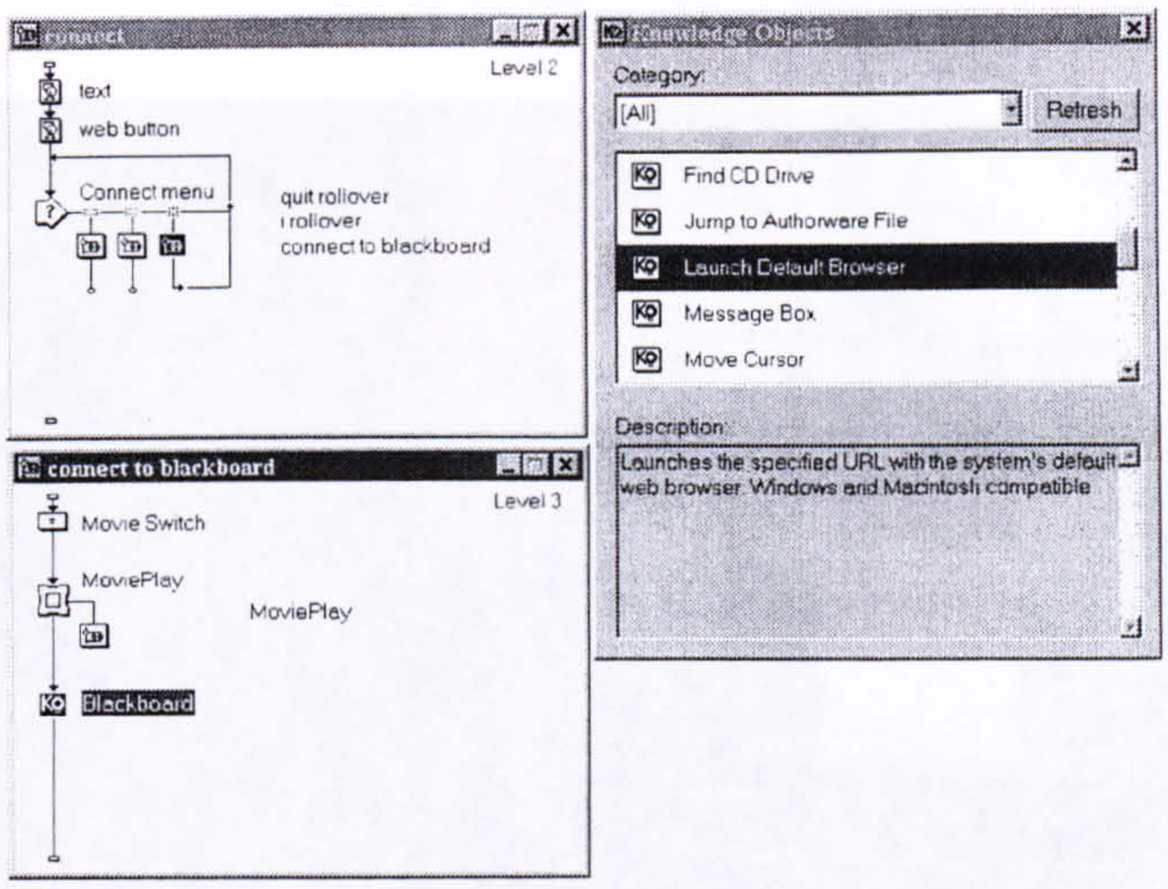


Figure 7.11 "Knowledge objects" enable seamless integration with web browser

Unfortunately video conferencing tests using Microsoft NetMeeting and Logitech QuickCamVC equipment were less successful. Although this form of communication was fully operational on the LMU Intranet (refer to Figure 7.12), the University (LMU) remained concerned that there were firewall security issues associated with the use of NetMeeting for "calls" made to locations outside the institution. As a consequence video conferencing on the Internet could not be integrated into DIME^{PM}. This problem is not peculiar to LMU. The university sector is currently investigating these issues and the United Kingdom Education and Research Networking Association (UKERNA) (http://www.jvcs.video.ja.net/) are soon to publish their findings.

7.7 Summary

Multimedia development requires a blend of design flair and programming skills. Authoring packages, such as Authorware 5.1 Attain, provide the developer with a range of features e.g. response type symbols, system variables and functions in scripted routines, to assist in the creation of interactive applications. However, these packages also draw together media from external sources and there is need to develop skills in a wide range of complementary software if a "polished" application is to be produced. DIME^{PM}, for example, relies heavily on Adobe Photoshop v5 and Adobe Premiere to create graphics and video sequences.

Figure 7.12 Synchronous communication using a QuickCam VC digital camera

Although the technical features and routines described in this chapter are aimed at enhancing interactivity and improving the user interface, it was not possible to fully exploit Internet capabilities within DIME[PM]. Insufficient bandwidth and security issues were major barriers. Attempts therefore to integrate web facilities within DIME[PM] are necessarily limited to the use of virtual learning environments and direct links to URLs.

Chapter 8

A methodological framework for the comparative evaluation of part-time, multiple media and distributed interactive multimedia learning programmes

8.1 Introduction

Evaluation of all components associated with multimedia design is central to the learning strategy advocated by Benyon *et al* (1997). A variety of data-gathering techniques are recommended that provide information upon which the "worth" of CAL applications such as DIME^{PM} can be established. Evaluation, therefore, provides decision-makers with information - it does not make decisions (Bramley, 1996).

Although evaluation is an essential part of any quality assurance process, many researchers have concluded that organisations frequently fail to evaluate adequately the value of training programmes (Plant and Ryan, 1994; McClelland, 1994: Mann and Robertson, 1996; Athanasou, 1998). The same is also true, Jacobs (1998) and McNaught (1999) observe, for the evaluation of courseware. Few pieces of software, they believe, are subjected to rigorous evaluation during development. Yet the investment needed in terms of development and production time, and capital to produce educational multimedia programmes can be significant. It makes financial common sense, if for no other reason, to evaluate the effectiveness of multimedia resources. Quite how an evaluation is undertaken, depends on the experience of the development team and the particular application e.g. the complexity of the instruction, the degree of interactivity, the amount of media used in the course and the amount of progress tracking demanded by the user (Oakes, 1997).

This chapter outlines a strategy for evaluating the pedagogic effectiveness of project management education and training resources, drawing on Kirkpatrick's (1996) systems-orientated strategy. Reference is also made to the B.P. Evaluation of Learning Technology (ELT) project, in the selection of an appropriate evaluation methodology (Harvey, 1998).

Data collection methods are discussed together with the measures employed to mitigate some of the problems commonly associated with the "obvious approach" (Draper, 1997) to evaluation.

8.2 Establishing a methodological framework

Jacobs (1998) suggests that evaluation should be regarded as the systematic review of the value and effectiveness of a piece of courseware. Accordingly, evaluation relies on a variety of experimental and other data before coming to objective conclusions. Edwards *et al* (1995) maintain that "as many evaluation methods and tools as possible" should be used during the "second stage" i.e. the user evaluation of the educational intervention. However, enthusiasm to collect large amounts of data must be guided by appropriate planning and tempered by realism, so as to avoid "evaluation overload". A methodological framework is an essential pre-requisite to data collection and analysis.

> *Variety in evaluation is good, fragmentation and incoherence are obviously not.*
>
> FDTL, 1997

Romiszowski (1984) recommends that a systems approach should be used for the evaluation of instructional programmes and that it should follow the general stages of:

- Problem definition;
- Analysis of general alternatives;
- Selection and synthesis of optimal solution(s);
- Controlled implementation; and
- Evaluation and possible revision.

In an educational context, systems evaluation seeks to improve the quality of an academic programme by the adoption of clearly conceived, systematic processes and the collection of data based on pre-determined objectives (Smith and Piper, 1990). The well-known work of Kirkpatrick (1960) provides a systems-orientated, hierarchical model for post-course evaluations which comprises the following four "levels":

- Level 1. Reaction;
- Level 2. Learning
- Level 3. Application; and
- Level 4. Results.

At Level 1, participants are asked what they think about the course or training programme they have received. Evidence suggests that evaluation of this type i.e. "Reaction", is the most frequently used by course trainers (Plant and Ryan, 1994) via end-of-course questionnaires or "happy sheets". However Mann and Robertson (1996), whilst conducting a longitudinal design through three of Kirkpatrick's levels, observed that participants who had very positive reactions did not necessarily learn more nor were they able to perform the trained skills any better than participants with less positive reactions. Athanasou (1998) arrives at a similar conclusion and recommends that further random samples should be taken to determine the "extent of learning" that has been achieved.

Kirkpatrick refers to this level of evaluation as the "Learning" stage. It is at this stage that emphasis is often placed on experimental approaches to evaluation. Gilleard (1997) used pre and post-test questionnaires to assess learning in a self-study programme and concludes that comparative testing enables participants to reflect on personal performance over the whole time span of learning. In isolation, however, this scientific form of evaluation is criticised for failing to take into account "unexpected outcomes and unintended consequences" (Smith and Piper, 1990).

Kirkpatrick's third level of evaluation i.e. "Application", seeks to determine the extent to which learning has been generalised to the work situation. However, this stage, necessarily involves more complex and costly instruments in order to measure behaviour change and improved job performance following training. These difficulties are further compounded at the "Results" stage, where the evaluation considers the benefit of training to the organisation. As Smith and Piper (1990) observe, the further along the "chain of consequences", the more difficult it is to measure the value of training. However, the importance of the Results stage should not be under-estimated, as it addresses the interests of all stakeholders (Athanasou, 1998).

Kirkpatrick's hierarchy of evaluation, originally developed in the late 1950s and early 1960's, has spawned many similar frameworks. For example, Morris (1984) proposes an eleven-point procedure, while Phillips (1991) describes an eighteen stage process. Unlike Kirkpatrick's strategy, however, which concentrates on post-course evaluation, these later models recognise the importance of identifying the aims and objectives of the training before the course commences. Context is important here and both models employ needs analyses prior to the design of the programme.

However, the setting of educational objectives, followed by the appropriate planning, implementation and review of the programme, it is argued, does not necessarily constitute evaluation (Rowe, 1996). If a course is not amended because it has largely achieved it's objectives then single-loop learning is said to have taken place (Argyris, 1991). Rowe (1996) states "that we can perhaps only move forward if we go back - back to the fundamentals of what we are trying to do". This so-called "back to basics" approach is referred to as double-loop learning. Evaluation requires the objectives themselves to be re-visited.

This argument echoes the views of Scriven (1967) who classifies evaluation as being either a formative process, which focuses on the improvement of the educational programme, or a summative process, which considers more broadly the programmes worth. Scriven (1967) takes an anti-objective stance, interviewing participants about the benefits they have derived from the programme without recourse to specific goals. In so doing he is able to evaluate the actual effects of the programme against the needs of the participants.

This so-called naturalistic approach, is taken further by Parlett and Hamilton's work (1977). They advocate the use of "illuminative evaluations" that encourage the description and interpretation of unplanned events and reject measurable quantitative objective led evaluation. Bramley (1991), while sympathetic to a naturalistic philosophy, believes that the approach will remain at "conceptual level", due primarily to the difficulty of translating objective-free evaluation into practice. However, he concedes that the collection of qualitative data about what affected the participants' value of the programme, might complement the more quantitative objective led evaluative data.

In this study, steps 1-9 of Driscoll's (1998) developmental model (refer to Section 6.2) are used to address the formative issues associated with the creation of a CAL program. It is contended, therefore, that Kirkpatrick's hierarchy provides an appropriate overarching strategy for the post-developmental evaluation of DIME^{PM} together with the more established multiple-media (MM) distance learning and Part-time (PT) delivery modes. Accordingly, an evaluation methodology is required that will determine "What does the student think of the course? What has the student learned? How has the student applied the skill learned? and "Has the organisation derived benefit?" (Plant and Ryan, 1994). The methodology, therefore, is not restricted to the use of quantitative methods alone. It does not exclude open forms of enquiry. Rather, the evaluation methods chosen are suitable for the purpose at hand (Benyon *et al* , 1997). Hence the proposed evaluation framework seeks to harmonise the evaluation strategy, CAL methodology and data collection methods in the achievement of a common, integrated goal (refer to Figure 8.1).

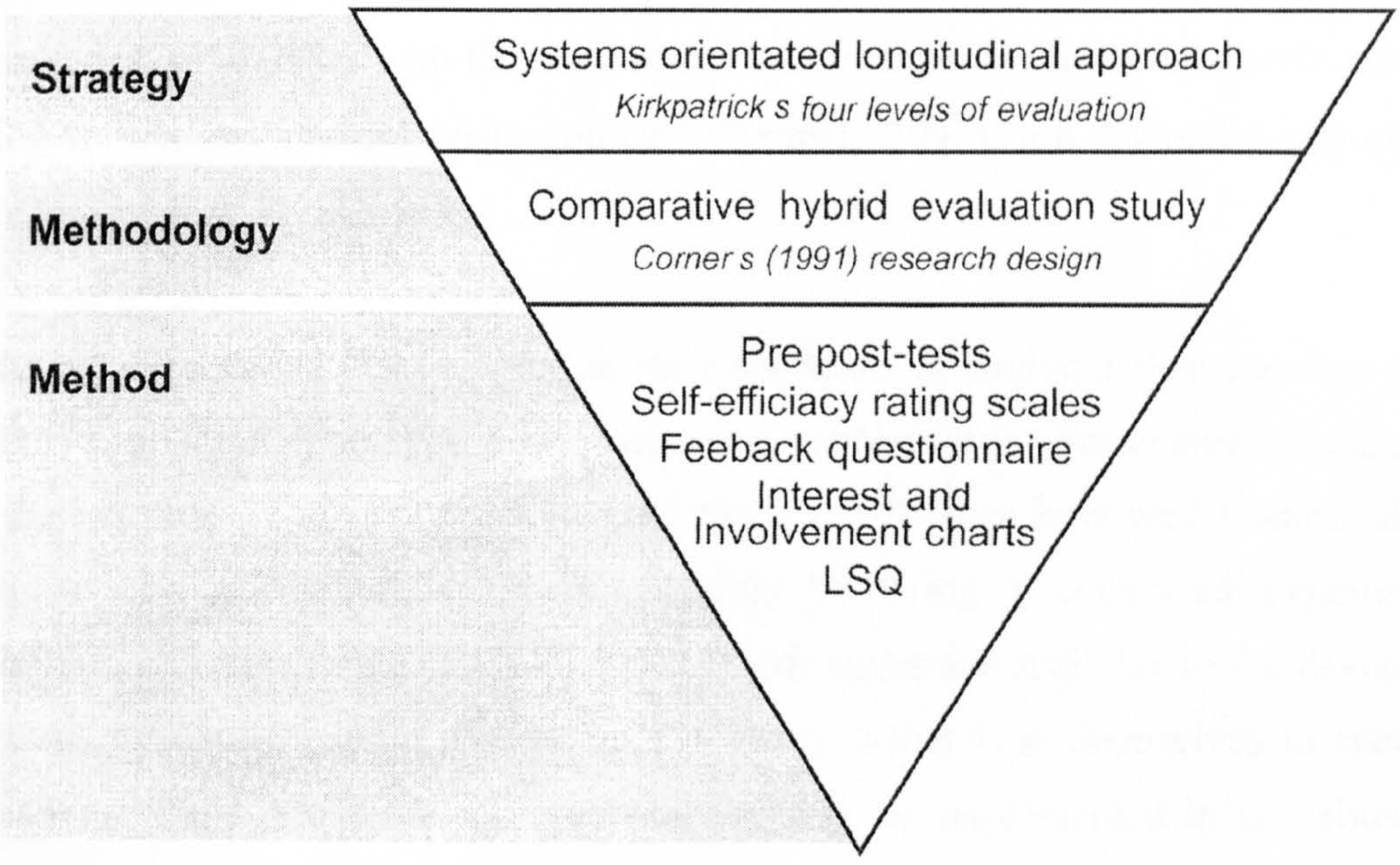


Figure 8.1 Methodological framework for post-development evaluation

This holistic approach enables a longitudinal research programme to be undertaken, addressing the concerns held by Gunn (1997a), Draper (1997) and Jacobs (1998) that the evaluation of new technology is frequently over-reliant on "pseudo-scientific empirical research" based on experimental methodologies.

It is a view shared by Henderson *et al* (1997) who consider that a systems approach takes account of how instructional delivery modes work in practice as opposed to an analytical approach that focuses solely on isolating effective instructional treatments. The research therefore builds on the work of Shinkins (1995) and Passerini (2000) which analyses "Level 1 Reaction" and "Level 2 Learning" respectively in an evaluation of computer based project management training packages.

8.3 Selecting an evaluation methodology for CAL

The inherent problems associated with the evaluation of CAL are clearly articulated by Draper (1997) who stresses that CAL does not "cause learning". There are perceived to be a multiplicity of factors that affect the pedagogic effectiveness of CAL software and as a consequence, evaluations should seek to determine their combined effect i.e. integrative evaluation. The shift in CAL evaluation methodology from isolation to "integration" is a feature of many studies in the 1990s (Draper, 1997; Gunn, 1997b; Gunn, 1998). Interdependence of content, context and individual characteristics together with the need to conduct evaluations in an "authentic context using mixed and multiple data sources" (Draper, 1997), are important aspects of research studies.

Oliver and Conole (1998a) emphasise the importance of having a clear question prior to the formulation of an appropriate evaluation methodology. For example, in answer to the question "Which of the following factors influences how well students do?", they suggest a comparative study, possibly involving a controlled experiment. However, a diverse range of evaluation methodologies are available to the developer of CAL resources. Some possess unique qualities that lend themselves to specific situations, while others are more general and can be implemented in any situation (Oliver, 1997). Many approaches are listed in the ELT Report Number 1 (Oliver, 1997) together with their relative strengths and weaknesses. The quasi-experimental research design, the illuminative method, the Open University method, Atkin's procedure for evaluation and the SECAL framework, are all perceived to be appropriate for the evaluation of pedagogic effectiveness.

Gunn (1997b) is fiercely critical of the experimental approach and develops a customisable evaluation framework for CAL research. Focusing primarily on learning outcomes, her Situated Evaluation of CAL (SECAL) adopts an integrative philosophy, examining the combined effects of CAL with other resources and forms of support ("Evaluation in context") and indirect influences at institutional level ("Evaluation of context"). Gunn (1998) states that it would be useful to know if students had any prior knowledge of the concept, how the module was integrated into the whole course and assessment structure and how CAL is in general received by students, presented by lecturers and supported by the institution.

All these factors, she concludes, can influence the effectiveness of learning outcomes. Her research, based upon the SECAL framework (refer to Figure 8.2), concentrates primarily on evaluation in context and is helpful in identifying intrinsic factors and extrinsic influences (or variables) that may impact upon the pedagogic effectiveness of CAL.

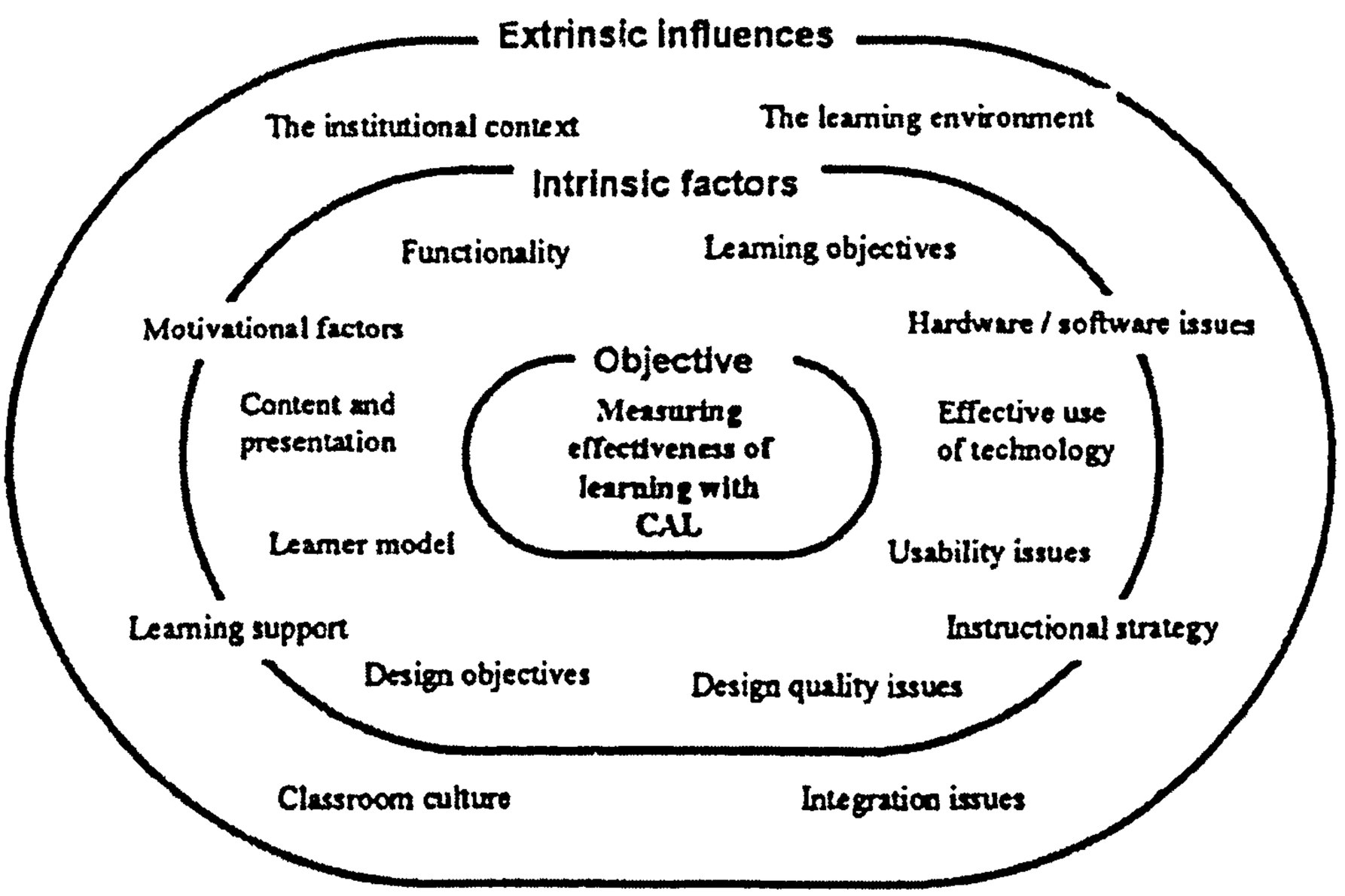


Figure 8.2 SECAL - a framework for situated evaluation of CAL (Gunn, 1997)

As Walker (1997) states, the identification of variables is a major issue in the research process for basic applied research. Joyes *et al* (1998) concur with Gunn (1998), stating that the evaluation of learning materials must take account of the whole learning experience and the full range of learning objectives. The methodology applied to evaluations, they argue, should therefore make use of both qualitative and quantitative techniques.

Oliver and Conole (1998b) propose that evaluation methodologies can be described in terms of: authenticity i.e. how closely an evaluation captures the context of an existing course; exploration i.e. whether the study has well defined hypotheses or is tackling an open question; and scale i.e. the number of participants in the study. A consideration of the study's aims, in terms of these three qualities, they suggest, will assist in the selection of an appropriate methodology. In a brief overview of Oliver's (1997) pedagogic toolkit for the evaluation of CAL, they outline four methodologies that demonstrate the diversity which currently exists (refer to Table 8.1).

	Authenticity		Exploration		Scale	
	Low	High	Low	High	Low	High
Experimental	X		X			X
Illuminative		X		X		X
Open University		X	X			X
Atkin's Method		X	X	X	X	

Table 8.1 A comparison of four different evaluation methodologies (Oliver and Conole, 1998b)

The toolkit is helpful, as it supports the view that a systems-orientated longitudinal study does not sit neatly within a purely scientific or naturalistic evaluation methodology. In order to gather data at each of Kirkpatrick's four "Levels" the methodology must embrace both quantitative and qualitative techniques so as to "produce generalisable as well as contextual findings" (Oliver, 1997).

Furthermore, the comparative evaluation of alternative delivery modes, proposed in Section 8.2, alleviates some of the problems associated with experimental research, namely "controlling confounding variables in an educational setting" (Oliver, 1997). However, this so-called "hybrid" approach to evaluation (Oliver, 1997) which permits the combined use of qualitative and quantitative methodologies in the evaluation of CAL has been criticised in other contexts. For example, Rooke *et al* (1997) argue, that a "multi-paradigm" approach is not conducive with the aim of developing greater rigour within research. Indeed, the quantitative-qualitative research methods dichotomy is not unfamiliar to the field of construction management. The relative importance of interpretative approaches highlighted by Seymour *et al* (1997) has prompted considerable debate regarding the value of 'rationalistic' research methods (Raftery *et al*, 1997; Runeson, 1997; Wing, 1998; Harriss, 1998).

Corner (1991), in a social science/educational context, suggests that triangulation might resolve this perceived polarity of view and thereby ensure that the advantages of each complement the other. Triangulation i.e. the combination of methods in the study of the same phenomenon, she argues, provides a richer and deeper understanding of the area under investigation than would otherwise be possible. This study, which seeks to determine the educational benefit of CAL (refer to Section 1.5.2), lends itself to a methodological approach which lies between the extremes of the controlled experimental and illuminative evaluation. Accordingly, a variety of instruments are employed (refer to Figure 8.3).

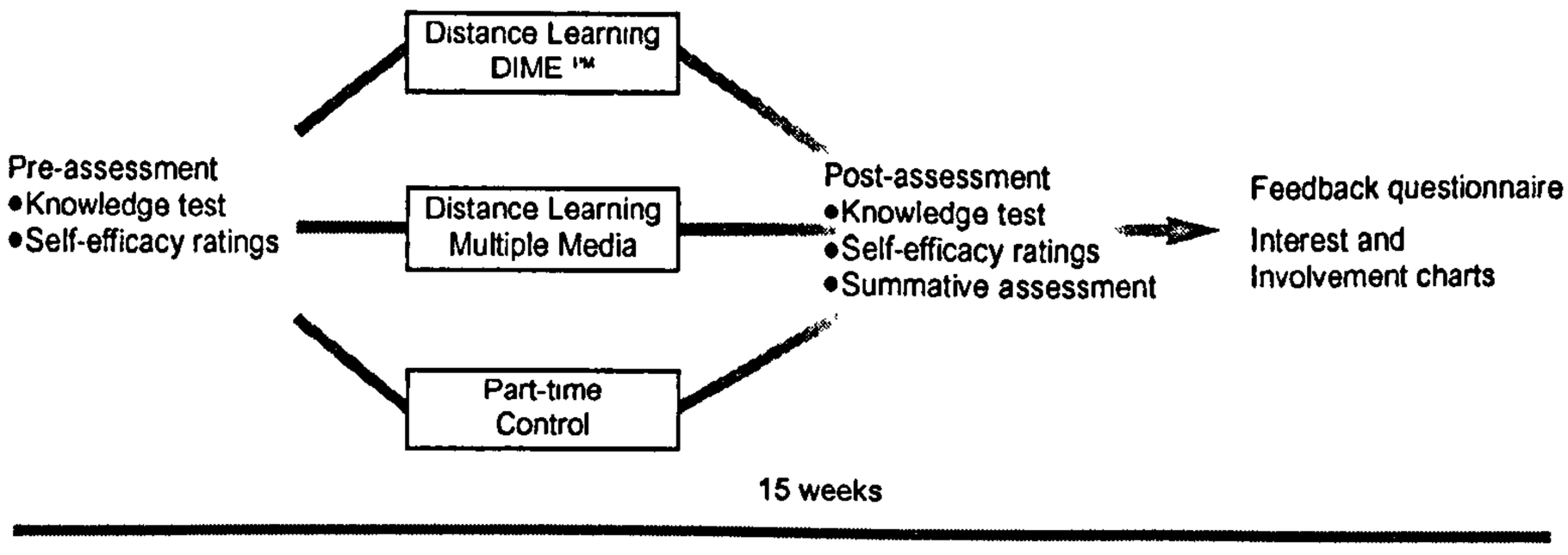


Figure 8.3 Project Management hybrid evaluation research design (adapted from Corner, 1991)

8.4 Methods used

The Tavistock Institute (1998) states that evaluation plans should be coherent, relevant and do-able. A combination of capture methods is recommended. The only limitation is to ensure that what is used, is manageable and in order to achieve a valid comparative analysis, Edwards *et al* (1995) suggest, evaluation instruments used at each stage of the evaluation process must be identical. The balance of open-ended and fixed methods of evaluation in this study reflect the mix of evaluation tools adopted by Corner (1991) and Mann and Robertson (1996) in their evaluation research designs (refer to Table 8.2).

	Evaluation Stage	Methods	Tools
Kirkpatrick's model	Reactions	Student attitude	Feedback questionnaire Interest and Involvement charts
	Learning	Student performance	Pre and post-tests Summative assessment
	Application	Student confidence	Self-efficacy rating scales

Table 8.2 Methods and tools used in comparative evaluation

8.4.1 Reactions

Feedback questionnaire

In accordance with the School of the Built Environment's QA procedures, feedback questionnaires (refer to Appendix G) were distributed at the completion of each module. Students were requested to identify three positive and three negative aspects of the study programme, and to add any other comments they wished to make. The format of the questionnaire is similar to that used by Oliver and Conole (1999) and allows factors that had not previously been foreseen to be identified and all views to be considered (Draper, 1997).

Oppenheim (1992) states that the chief function of instruments designed to gather attitude statements, is to divide people roughly into a number of broad groups, so that these may be analysed in relation to other variables in the survey - in this study the mode of delivery (refer to Section 9.6). Therefore a unique identifier, the student ID, was required together with a check box to indicate to which of the delivery modes the student had been allocated. Students were assured of confidentiality and that their collective responses would be of value in the formative development of the module.

Interest and Involvement charts

Interest and Involvement evaluation charts (Bartram and Gibson, 1993) complement the standard LMU feedback questionnaire. This instrument provides a method of gathering information from learners about their feelings during the module (Bartram and Gibson, 1999) and introduces variety to the manner in which data is collected (refer to Appendix G). Students were requested to plot their level of interest and involvement on a chart during their period of study and create a profile of the interest generated by each topic and subsequent assessment. In addition they were able to insert further comments relevant to the delivery of the module.

Bertram and Gibson (1999) suggest that the data collected enables patterns in student responses to be examined (refer to Section 9.6.2) and assists in determining "what has and has not worked for learners, what learning may have been missed and what improvement learners have suggested" (Bertram and Gibson, 1999). The charts were distributed at the commencement of the module and again required the student ID and delivery mode to be identified.

8.4.2 Learning

Pre and Post-testing

Dugard and Todman (1995) acknowledge that the pre post-test control group design is particularly common in educational research which examines the change in outcomes that result from modifications to the learning process. The design is shown below:

Control (PT)	$O_{1,2}$	X_1	$O_{3,4}$
Experimental (MM)	$O_{1,2}$	X_2	$O_{3,4}$
Experimental ($DIME^{PM}$)	$O_{1,2}$	X_3	$O_{3,4}$

$O_{1,2}$ refers to the pre-test (learning gain and self-efficacy)[1]

$O_{3,4}$ refers to the post-test (learning gain and self-efficacy)

X represents the exposure of a group to a particular delivery mechanism

Random selection of students within cohorts is recognised as being an important aspect of experimental studies (Fraenkel and Wallen, 1996) if the impact of extraneous variables associated with particular cohorts and individuals are to be removed. However, the part-time treatment, delivered in the 1999/00 academic year, comprised in tact groups. Course Committee approval did not extend to the concurrent delivery of part-time and distance learning formats in the same semester. While this is acknowledged as a limitation of the study, various measures were put in place to eliminate or minimise the possible threat this might cause to internal validity. Newton (1998) offers advice in this respect. He suggests that student profiles are created that reflect motivational, personal and educational factors. The control and experimental groups, therefore, comprised students from the same courses, with similar age, gender and learning style profiles (refer to Appendix F). Marchant (2001) refers to this procedure as stratified sampling. Paired testing of students using a matching-only pre post-test control group design was not adopted due to sample size. As such, the evaluation did not assume a true experimental design and therefore the necessary correlation between the dependent and independent variables had to be "fairly substantial" (Fraenkel and Wallen, 1996).

Prior to the commencement of the Project Management module, a pre-test was administered to establish a baseline of knowledge and technical skills, and establish the confidence of participants in undertaking certain project management related tasks (refer to Section 8.4.3).

[1] Conventions devised by Campbell and Stanley (1963)

The former contained questions which were mapped against each of the three content related "Units" i.e. Project Perspectives, Tools and Techniques and Interpersonal Skills, in order that the instrument reflected the content balance within the module[2]. In accordance with procedure outlined by Kromrey and Purdom (1995) all questions were validated by two "judges" i.e. module tutors, who were conversant with the content in the instructional material.

Design, Newton (1998) states, is critical to the success of the test. He recommends that a proportion, though not all, of the original test materials are retained in the subsequent post-test. Repetition of the same test questions, he concludes, is not a sound solution to achieving comparability. In order to ensure the reliability of the instruments a cross-over design or equivalent forms re-test (Fraenkel and Wallen, 1993) was employed, whereby two tests were randomly assigned to students, either as a pre or post-test.

The pre and post-tests followed the guidelines described by Wilson *et al* (1998), and were designed such that "it did not take long to complete" i.e. 30 minutes. They comprised short-answer questions, with few multiple-choice questions being used (refer to Appendix D). The latter were excluded from the later analysis, thus ensuring that correct responses could be attributed to students definitely knowing the answers (Wilson *et al*, 1998). The pre-test was administered prior to the induction event and the post-test immediately upon completion of the module.

Reinforcement of test concepts has the added value of contributing to knowledge assimilation (Mann and Robertson, 1996). Clearly, such testing can be of benefit to participants but it is also acknowledged that the measure of change in learning might be inflated if the tests are conducted immediately on completion of the programme. Mann and Robertson (1996) recommend that post-tests be undertaken one month after the training programme in order to provide a more realistic evaluation. This requirement could not be satisfied due to the structure of the postgraduate awards. Attempts to gain student support for evaluations conducted outside the registration period were deemed impractical. A low student response rate was expected.

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[2] Students were alerted to the status of the evaluation i.e. the tests were being used to evaluate the learning materials and not to evaluate individuals, as recommended by Draper *et al* (1996)

Macleod (1998) suggests that "analysis of data gathered through an experimental approach will most likely focus on determining whether your innovation has had the particular effect". However, he cautions against thinking that statistical significance is "an all or nothing thing". Rather it is used to express the researchers confidence in the conclusions put forward.

Summative assessment

The premise that evaluation can be divorced from the assessment of the merits and demerits of the student work is criticised by Jacobs (1998). Assessment is perceived to be a subset of evaluation. Therefore the summative assessment in the Project Management module, which comprises two components (refer to Appendix E), adds a further source of data to the holistic evaluation:

- Part 1 - A presentation to camera, the topic being self-selected from a pre-defined list of debate motions (40% total module marks); and
- Part 2 - An assignment that required the preparation of a network, bar chart and functional linear responsibility chart (60% total module marks).

Kirkpatrick (1967) argues that evaluations of this nature provide evidence, not proof of benefit. Indeed, the need for alternative "measures" is reinforced by Newton (1998) who states that one must be prepared to make "only very limited claims for any findings which seek to provide an accurate measure of the change in learning which can be attributed to the intervention" (Newton, 1998).

8.4.3 Application

Kirkpatrick (1960) suggests that there may be a difference "between knowing principles and techniques and using them on the job". Following a review of experiments that measured the effectiveness of training programmes in terms of on-the-job behaviour, he concludes that in order to determine effectiveness, attempts must be made to measure work-place performance. Mann and Robertson (1996) examined the relationship between learning and on-the-job performance, using self-efficacy i.e. the conviction that one can successfully execute the behaviour required to produce outcomes (Bandura, 1977), as a "surrogate" measure of performance.

Self-efficacy is different from outcome expectations. Although individuals may believe that a certain course of action will produce certain outcomes, they may have serious doubts about whether or not they can perform the relevant activities (Robertson and Sadri, 1993). Self-efficacy, therefore, is viewed as a form of self-confidence more narrowly focused on the perception that a specific task can be undertaken successfully (Bramley, 1996).

Mann and Robertson's (1996) findings revealed a significant correlation between how much was learned in training and the improvement in self-efficacy immediately after training. However, this relationship was not maintained beyond the initial acquisition phase. Although participants did not retain all they had learned one month after training, interestingly, self-efficacy measures remained constant. They conclude that learners rely less upon declarative knowledge (i.e. facts and information) and more on procedural knowledge (i.e. how actually to do something). Self-efficacy improvements after training do transfer to the working environment and are therefore useful measures of the success of training programmes (Mann and Robertson, 1996).

A self-efficacy evaluation instrument is used in this study to predict the performance of project management students in the work place. An identical pre post-test design to that described in Section 8.4.2 is adopted. The tool itself is based on a managerial self-efficacy scale developed by Robertson and Sadri (1993) and the research of Lucas *et al* (1997) which assessed a person's self-efficacy for specific organisational tasks.

The approach adopted by Robertson and Sadri (1993) comprised the following four stages:

- identify the behavioural category to be measured;
- represent the behavioural category as a set of specific activities or task items;
- arrange these task items into a hierarchy of increasing difficulty; and
- request the respondent to assess his/her degree of certainty that he/she can perform the activity when exerting maximum effort.

Recommendations regarding the length of the self-efficacy inventory, scale development, the degree of difficulty of the tasks, reliability testing and directions regarding the use of the instrument were adhered to during the design and implementation of the instrument.

Four experts, chosen from the postgraduate project management Course Team in the School of the Built Environment, were asked to match a list of specific tasks against the outcomes i.e. the "behavioural category", identified in the Project Management module specification (refer to Section 4.5).

The preliminary list, in accordance with the second step in the scale construction process, was based upon the APM BoK (3rd Edition) and comprised 100 task statements[3]. Kinicki and Latack (1990) suggest that tasks, with less than 50% agreement, should be omitted from the scale. Therefore it was decided to select only those statements from the preliminary list that achieved 75% agreement (minimum) or where there was an even split between two matched outcomes. The final scale (refer to Table 8.3) comprised 34 specific task items.

Unlike Robertson and Sadri's (1993) design however, the items were randomly listed (refer to Appendix C). Neither rankings nor weightings were necessary for subsequent analysis (refer to Section 9.4). However, each item in the scale was rated on a 10-point scale ranging from 0 "no confidence" to 9 "complete confidence". Oppenheim (1992) states that the number of items in a Likert scale are arbitrary. Although a 5 point scale is widely used, a range of other formats may be employed (Cormack, 1996). Cormack argues that whatever the format, the basic task is the same i.e. to indicate the extent to which the respondent accepts or rejects various statements relating to an attitude object. It was decided, therefore, to mimic the procedure adopted by Lucas *et al* (1997) in a similar self-efficacy evaluation[4].

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[3] DeVellis (1991) recommends the use of a pool of items three times as large as the final scale.

[4] Hoinville and Jowell (1978) note that some researchers favour a 10 point scale, since it is an easy and familiar task to most respondents, but that no uniform view has emerged on the best number of points to include in scales.

Outcome	Item
Project objectives	Identify the environmental factors e.g. economic, social, cultural, political and ethical, which impact upon a project
	Translate client requirements into a project brief
	Define goals and objectives in difficult situations
	Draft project documents in an appropriate format
	Prepare a project brief that gives a clear direction on the relative balance between the conflicting parameters of Time, Cost and Quality/Function
	Satisfy the social and political constraints within the project strategy
	Develop, document and maintain the project brief as an accurate and comprehensive statement of the client's requirements
	Manage the preparation of the client brief
	Identify what (standards, performance, requirements) the customer really wants
	Establish and maintain a vision of the project objectives
Tools and techniques	Apply project management techniques and concepts in the realisation of a project
	Use and prepare a Work Breakdown Structure for a variety of projects
	Use project risk analysis and management on many different types of project
	Implement a variety of value management methods
Interpersonal skills	Communicate complex arguments effectively in a short period of time
	Get people to work and achieve goals and objectives in difficult situations
	Draft concise, accurate and relevant written communication for all levels in the project team
	Formulate and present ideas at all levels in the project
	Deliver effective verbal communication at all levels in the project team from strategy meetings with the client through formal briefings to routine progress meetings
	Minimise conflict and direct all parties efforts towards achieving the project goals
	Integrate teams of different specialist groups, possibly in conflicting situations and involving large projects to achieve a successfully integrated final product
	Delegate a substantial proportion of project work to others
	Resolve conflict in projects
Operational plan	Prepare a strategic plan for a project in at least one industry
	Design and establish a range of organisations for projects of different sizes and degrees of complexity
	Plan the various stages of a complex major project
	Draft a framework for the ongoing reference and control of the project process
	Advise on the organisational and contractual options for allocating risk
	Develop a project procurement strategy
	Define the structure of the project team
	Define clearly the roles and responsibilities of team members
	Determine the duties and responsibilities in law of the parties to a contract
	Advise upon the principal forms of contract which are used in the procurement of services for a project
	Prepare contract documentation and develop a supplier acquisition plan

Table 8.3 The 34 item Project Management Self-efficacy Scale

The project management self-efficacy scale was administered prior to the commencement of the module and again on completion of the educational programme. The following directions were given to students:

> *"For each of the activities described in the questionnaire, consider yourself when making your very best effort"*
>
> (Robertson and Sadri, 1993)

> *"Indicate the extent to which you would be confident of your capability to successfully complete the following activities on a regular basis"*
>
> (Lucas *et al*, 1997)

In order to check internal consistency of the instrument a Cronbach's Alpha reliability coefficient was calculated. Cronbach's Alpha describes how well a group of items focuses on a single construct and is often used with attitude instruments that use Likert scales (Siegle, 2001). The Statistical Package for the Social Sciences (SPSS) was used to analyse the data generated by the first implementation of the self-efficacy rating scale. The coefficient, based on an analysis of the data generated by the first implementation of the self-efficacy rating scale (refer to Table 8.4), indicates a very high internal validity (0.955).

```
R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

Reliability Coefficients

N of Cases =     30                      N of Items = 34

Alpha =    .9552
```

Table 8.4 Cronbach α: SPSS output

8.5 Problems associated with the evaluation of CAL

Jacobs (1998) acknowledges that experiments form the "backbone of evaluation". However, she supports the reservations expressed by Draper (1996), that experimental techniques (including learning tests) in an educational setting are fraught with difficulties - difficulties that are exacerbated when the evaluator attempts to compare the learning gain achieved by alternative delivery methods. Isolating the effect of software on learning gain, she states, is clouded by the presence of "myriad human variables" and the potential Hawthorne effect, as evaluations unintentionally create an environment that is different from the normal learning situation.

Campbell and Stanley (1963) provide a comprehensive list of extraneous variables that might jeopardise both the internal and external validity of experiments. Variables relevant to this experiment are:

- Testing - "sensitising subjects to the true purposes of the experiment" (Cohen and Manion, 1994) thereby producing higher post-test scores;
- Instrumentation - unreliable tests;
- History - specific events occurring between the pre and post-test;
- Biases - selection bias brought about by the use, for example, of in tact classes as experimental or control groups; and
- Experimental mortality - student withdrawal and low return of evaluation measurements.

The following measures, therefore, were implemented to reduce these problems and others associated with the so-called "obvious approach" to evaluation raised by Draper (1997). The concerns raised by Draper (1997) are addressed first.

The original part-time module study guide was re-formatted by the Capability Learning Support Unit in the Faculty of Health and Environment at LMU. The Unit was similarly responsible for the design of the multiple media and DIME^{PM} resources. Multiple media resources were distributed in a bespoke wallet and DIME^{PM} in a pre-formed case.

A conscious effort was therefore made to reduce potential Halo effects resulting from perceived differences in the presentational qualities of the learning materials (Draper, 1997).

Face-to-face contact between lecturers and students is a dominant feature of traditional delivery methods. As Draper (1997) observes, learning gains may be the result of student motivation, which in large part is attributable to the teacher's role. Hence an induction event preceded the delivery of both the multiple media and DIME^{PM} modes and lecturers, who contributed to traditional delivery of the module, were invited to take part in the induction event.

The notion of eliminating the teacher from subsequent involvement in the multiple media and DIME^{PM} modes, on the grounds that this would introduce a further variable in the experiment, was discarded. Draper (1997) argues that the absence of the tutor would create a different learning situation from that commonly experienced. All students were encouraged to contact their tutor, whether this be face-to-face contact or by telephone, fax or email. The frequency and content of all interventions was recorded so as to determine the extent to which students made use of their academic tutors (refer to Section 9.5).

Draper (1997) also suggests that the teacher's attitudes to technology might influence students in the use made of CAL software. Hence student briefing focused on the issue of flexibility in delivery rather than outlining the rationale for the development of innovative technology-based learning approaches.

Draper supports Campbell and Stanley's contention that evaluation tools might affect student attitude (i.e. the Hawthorne effect) and, in the case of the pre-tests, exaggerate the learning gains as a direct consequence of reinforcement and practice (Wilson *et al*, 1998). The comparative evaluation used in this study ensured that relative learning gains could also be analysed (refer to Section 9.3.2).

Reliability refers to the consistency of the results obtained from the tests (Fraenkel and Wallen, 1996). The three most popular methods to obtain a reliability coefficient, they posit, are the test-retest method, the equivalent forms method and the internal consistency methods i.e. the split-half procedure, the Kuder Richardson approaches (KR20 and KR21) and the alpha coefficient. The measures taken to determine the reliability of the instrumentation in this study are described in Section 8.4.

All postgraduate courses at LMU adhere to a modular framework, which complies with the University's "Academic Principles and General Regulations Governing Awards". Although the credit attached to each module varies, students frequently study modules in parallel. Part-time postgraduate courses typically extend over two calendar years and comprise ten 12 credit modules. "Historical" influences i.e. the acquisition of complementary knowledge and experience during the study period, are minimised by rigorous course approvals procedures that prevent the duplication of content within a set programme of study.

The evaluation also raises two important ethical issues i.e. the appropriateness of distance learning delivery within existing part-time courses and the allocation of study mode to individual students. The former could only be resolved at Course Committee where approval was required, in accordance with the University's quality assurance procedures[5], in order to proceed with distance learning delivery of the module. The latter relied upon the willingness of students to take part in the research study. Prior to enrolment part-time students were informed that the Project Management module was to be delivered in distance learning format and that, should they so wish, they could opt out of the comparative evaluation.

Relevance and coherence of content within a course is the responsibility of the Course Team. Failure to provide these basic tenets of course design may, it is argued, lead to higher attrition rates and failures. Although prima facie this would appear to be less of a concern for "core" modules, "elective" modules may be chosen by ill-informed students. Accordingly tutors attended "elective fairs" to reduce this possibility and hopefully to improve experimental mortality during the period of the research study.

[5] Approval to deliver the Project Management module in distance learning format on MSc Construction Law and Arbitration and MSc Project Management was limited to the period of the research study.

8.6 Summary

Opinion is divided as to the relative merits and demerits of qualitative and quantitative approaches to educational research. Accordingly the "hybrid" evaluation methodology used to determine the pedagogic effectiveness of DIME^{PM} in HE may be regarded as a compromise. However, the instruments used in this longitudinal evaluation gather data at various stages (i.e. Reaction, Learning and Application) in the educational programme. A variety of data collection tools, it is submitted, is therefore a natural consequence of the approach taken.

However, Kirkpatrick's 4th level of evaluation is excluded from the HE research study. As such this may be regarded as a weakness in the holistic philosophy proposed. The problems i.e. ethical and scale, associated with determining the extent to which the interests of all stakeholders are met, prohibited such study. Despite concerns that a "secondary evaluation" of DIME^{PM} in an industry setting might be construed as a break in Bramley's (1991) "cause-and-effect chain", it is contended that an illuminative case study is able to highlight organisational issues that affect CAL in the work-place.

Analysis of the data generated by the instruments described here and subsequent research findings are reported in the following chapter. A detailed exposition of the industry-based evaluation study is contained in Chapter 10.

Chapter 9

Data collection and analysis

9.1 Introduction

The systems approach adopted in this study necessarily requires data to be collected throughout the period of delivery. A range of instruments, based upon research designs outlined by Corner (1991), Mann and Robertson (1996) and Wilson *et al* (1998), are used to gather data:

- "Summative" assessment;
- Pre post-testing;
- Self-efficacy rating scales;
- Feedback questionnaires; and
- Interest and Involvement charts.

This chapter describes the sample and procedural aspects associated with the implementation of these tools. Statistical analysis of quantitative data, collected over a three-semester period, is complemented by further interrogation of qualitative data in order to complete a hybrid evaluation as recommended by Oliver (1997).

9.2 Sample

Harvey (1998) argues that involving the whole cohort in an evaluation study will provide a more representative sample than would otherwise be achieved by testing a small sample. Accordingly, all students enrolled on the Project Management module were invited to take part in the evaluation study. However, the number of postgraduate students enrolled on the module was not large. Newton (1998) states that "ideally" one should aim to achieve a student group of at least 30 for pre and post-testing, therefore, the evaluation was conducted over a three-semester period.

Newton (1998) emphasises the need to create student profiles (refer to Section 8.4.2). This was achieved by reference to Student Information Services (SIS) records at Leeds Metropolitan University. SIS listings in the 2000/01 academic year indicated that the course composition, age and gender balance matched that in 1999/00. However, the learning styles profiles of students were gathered via a LSQ (refer to Appendix F) which was distributed with the initial enquiry. The sample size was 126. However, four students returned their CD-ROM in exchange for the multiple-media learning pack and a further eighteen students withdrew from the module (3 No. PT; 5 No. MM; 10 No. DIME^{PM}), prior to submission of the Part 1 assessment. Despite the loss of subjects from the sample (17.5%), it is contended that the profiles (refer to Table 9.1) are sufficiently similar to allow a comparison of the control and experimental groups. A complete listing of students in the research study is contained in Appendix H.

	Group profile		
	PT *n*=27	MM *n*=44	DIME^{PM} *n*=33
Mean age (s.d.)	34.4 (7.58)	33.0 (7.93)	35.8 (7.72)
Gender balance	20 male/ 7 female	31 male/ 13 female	25 male/ 8 female
Learning style[1]			
Activist (%)	3 (11)	5 (11)	4 (12)
Pragmatist (%)	9 (33)	14 (32)	10 (30)
Reflector (%)	10 (37)	15 (34)	14 (42)
Theorist (%)	5 (19)	10 (23)	5 (14)
Course			
PM (%)	9 (33)	18 (41)	10 (30)
FM (%)	6 (22)	9 (21)	8 (24)
CLA (%)	4 (15)	5 (11)	2 (6)
MBA (%)	8 (30)	12 (27)	13 (40)

[1] LSQ strongest preference

Table 9.1 Sample group profiles

The reason cited for the return of DIME^{PM}, in all cases, was due to technical problems associated with the audio and video capabilities of student computer platforms.

The high withdrawal rate, although a concern, is peculiar to the administration of courses within the School of the Built Environment and Leeds Business School at Leeds Metropolitan University. It is common practice for students to attend induction events for elective modules before making their decision regarding which assessment to undertake.

9.3 Learning gain

9.3.1 Summative assessment

A box-plot of the combined Part 1 and 2 assessment indicates that the median score for part-time students is higher than their peers in the experimental groups (refer to Figure 9.1). The mean scores for each group are PT = 56.4%, MM 57.1% and DIME^{PM} 54.3%. However a one-way analysis of variance (ANOVA) indicates that there is no significant difference between the means of the three groups on total scores ($F_{2,101}$=1.184, p=0.310).

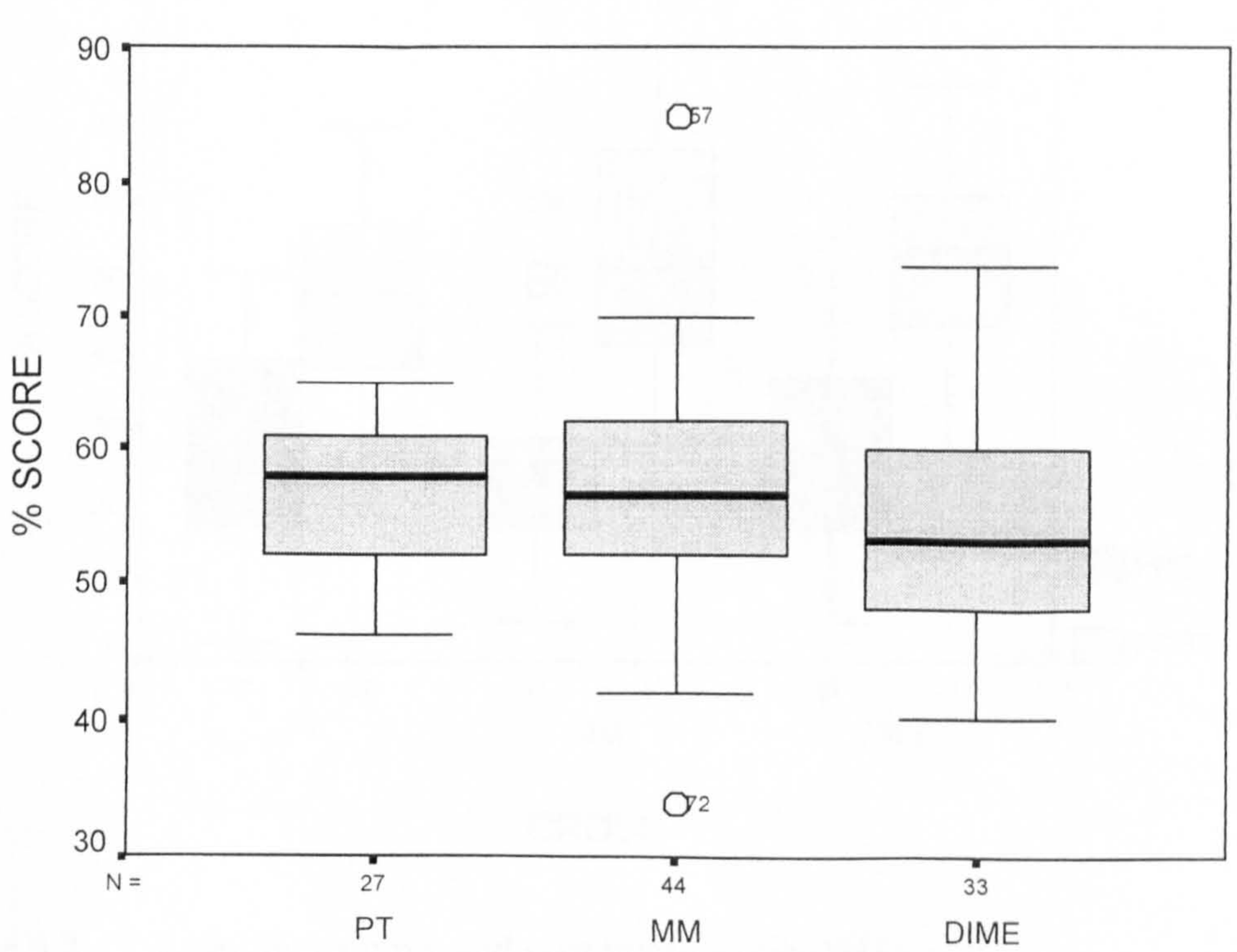

Figure 9.1 Parts 1 and 2 (combined) summative assessment (SPSS v10)

9.3.2 Pre and Post test

Pre- and post-tests were analysed to discover if there had been a "learning gain" (Wilson *et al*, 1998). All students were required to undertake a pre-test during the induction event that preceded the module. Two tests (A and B) were prepared (refer to Chapter 8) and a "cross-over" design was employed. An independent samples t test (not assuming equal variances) reveals no significant difference between pre-test A and pre-test B mean scores ($t_{91.4}$=0.73, p=0.465, 95% CI of A and B -6.7+3.1). Of the 104 students, 97 performed better in the post-test than in the pre-test, two students achieved the same result and five students performed worse in the post-test. However, Wilson *et al* (1998) suggest that experimental methods *per se* exaggerate the learning gains promoted by the educational programme, as a direct consequence of reinforcement and practice. Figure 9.2 shows a box plot of the pre and post-test scores achieved in each delivery mode.

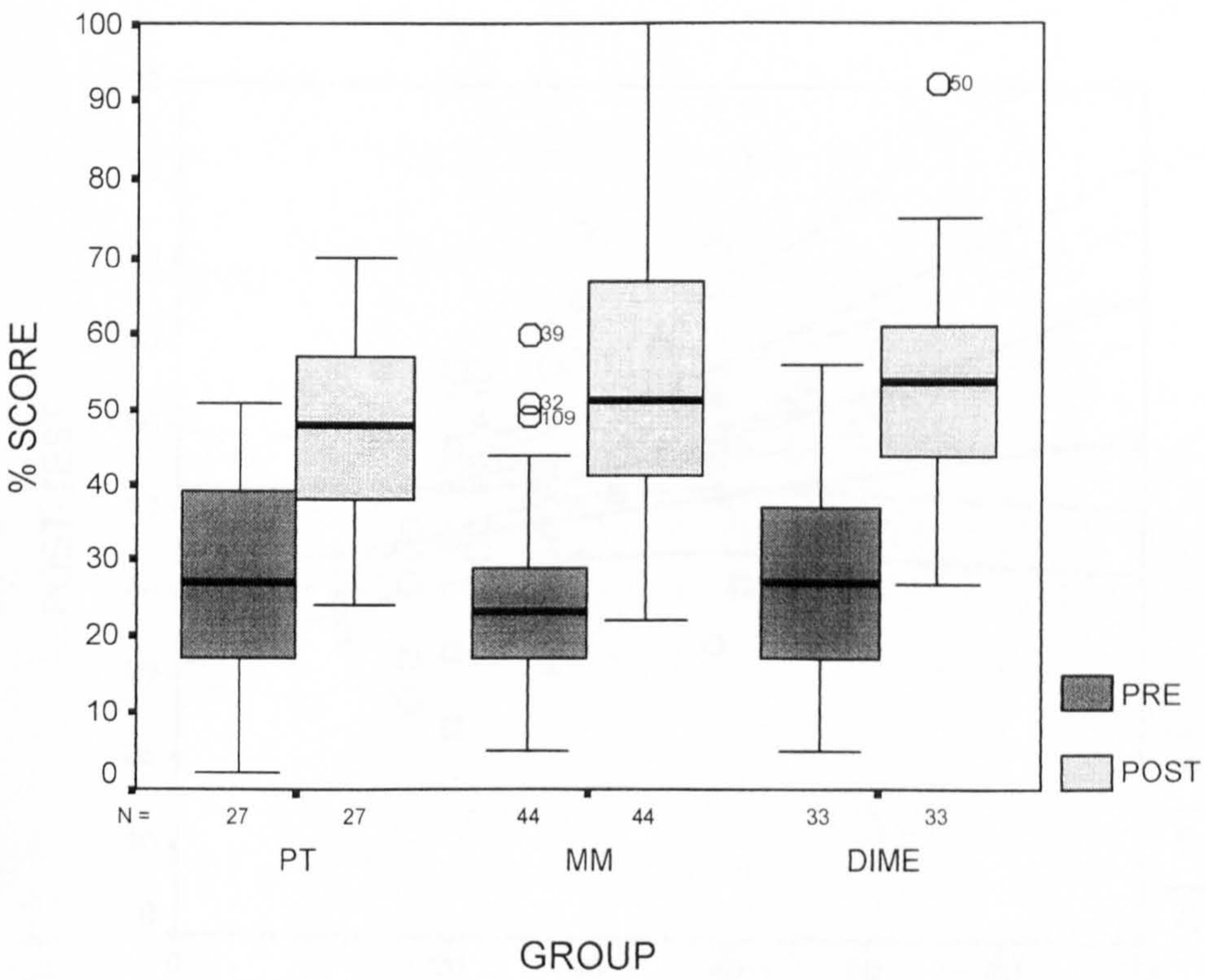

Figure 9.2 Learning gain pre and post intervention (SPSS v10)

Unlike the One Way ANOVA, applied to summative assessments (refer to Section 9.3.1), an analysis of co-variance (ANCOVA) on post-test scores was calculated, using the pre-test score as the co-variate. The argument that ANCOVA assigns the pre-test its "correct status as a true co-variate" (Dugard and Todman, 1995) was persuasive in the selection of an ANCOVA on post-test scores.

However, for an ANCOVA it must be assumed that there is linearity in the relationship between pre-test and post-test, that the regression lines are parallel (Marchant, 2001) and that there is homogeneity of variances of residual post-test scores (Dugard and Todman, 1995). A quadratic term (i.e. the squared pre-test score) was introduced to account for a curved line relationship but was found not to be significant. A scatter plot of the pre and post-test scores (refer to Figure 9.3) suggests that parallel regression lines are a reasonable assumption and from an analysis SPSS normality plots there appears to be homogeneity in the variances of residuals.

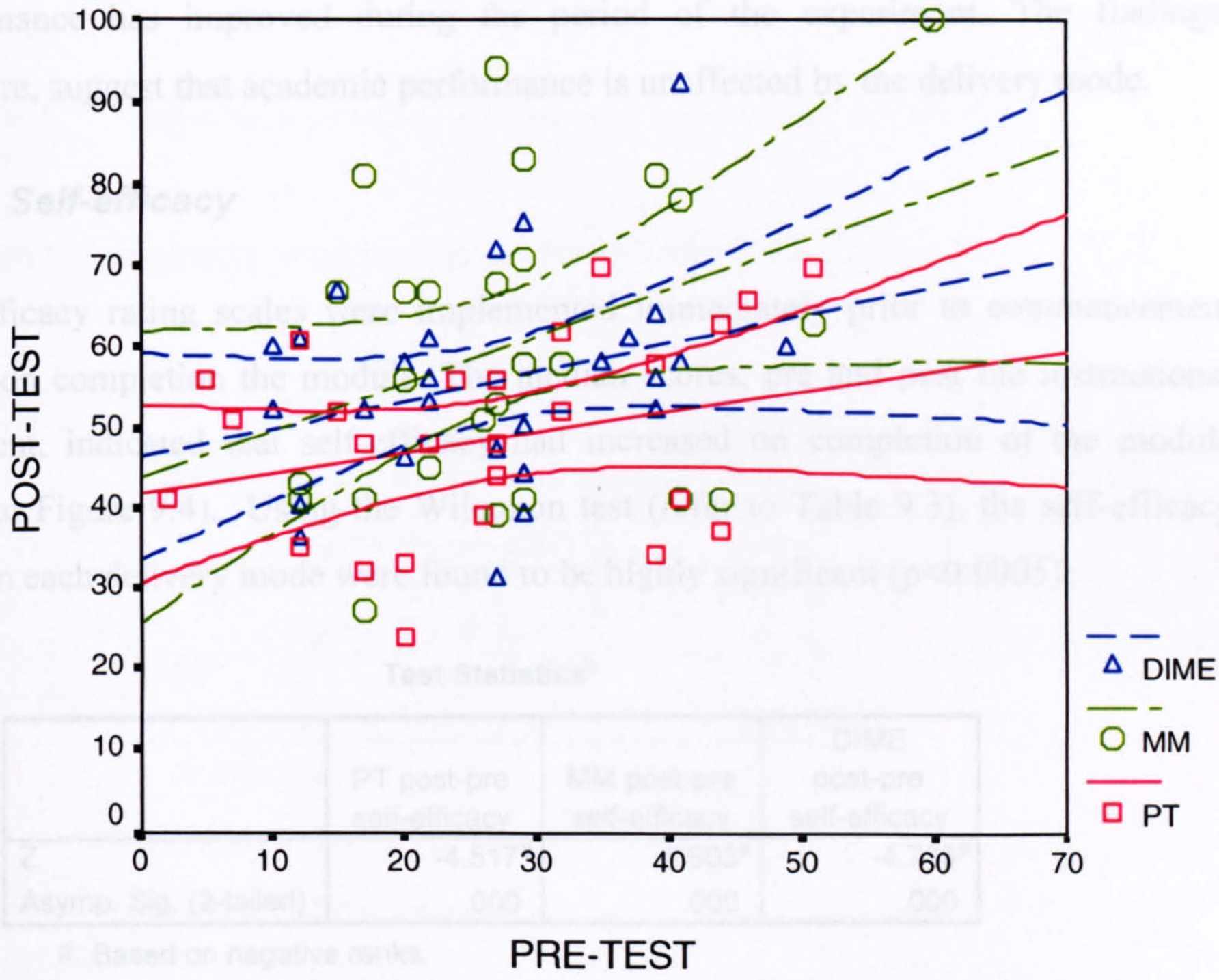

Figure 9.3 Scatter plot (SPSS v10)

Neither MM nor DIME[PM] showed a significant improvement over the control group (refer to Table 9.2)

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	35.539	4.074		8.724	.000
	PRE	.487	.113	.391	4.302	.000
	DIME	4.992	3.678	.152	1.357	.178
	MM	5.932	3.468	.192	1.710	.090

a. Dependent Variable: POST

b. Selecting only cases for which GROUP >= 1

Table 9.2 ANCOVA: SPSS output

It is concluded therefore that there is no significant difference in the learning gain between the control and experimental groups. Yet there is a clear indication that performance has improved during the period of the experiment. The findings, therefore, suggest that academic performance is unaffected by the delivery mode.

9.4 Self-efficacy

Self-efficacy rating scales were implemented immediately prior to commencement and upon completion the module. The median scores, pre and post the instructional treatment, indicated that self-efficacy had increased on completion of the module (refer to Figure 9.4). Using the Wilcoxon test (refer to Table 9.3), the self-efficacy gains in each delivery mode were found to be highly significant ($p<0.0005$):

Test Statistics[b]

	PT post-pre self-efficacy	MM post-pre self-efficacy	DIME post-pre self-efficacy
Z	-4.517[a]	-5.603[a]	-4.735[a]
Asymp. Sig. (2-tailed)	.000	.000	.000

a. Based on negative ranks.

b. Wilcoxon Signed Ranks Test

Table 9.3 Wilcoxon Signed Ranks Test: SPSS output

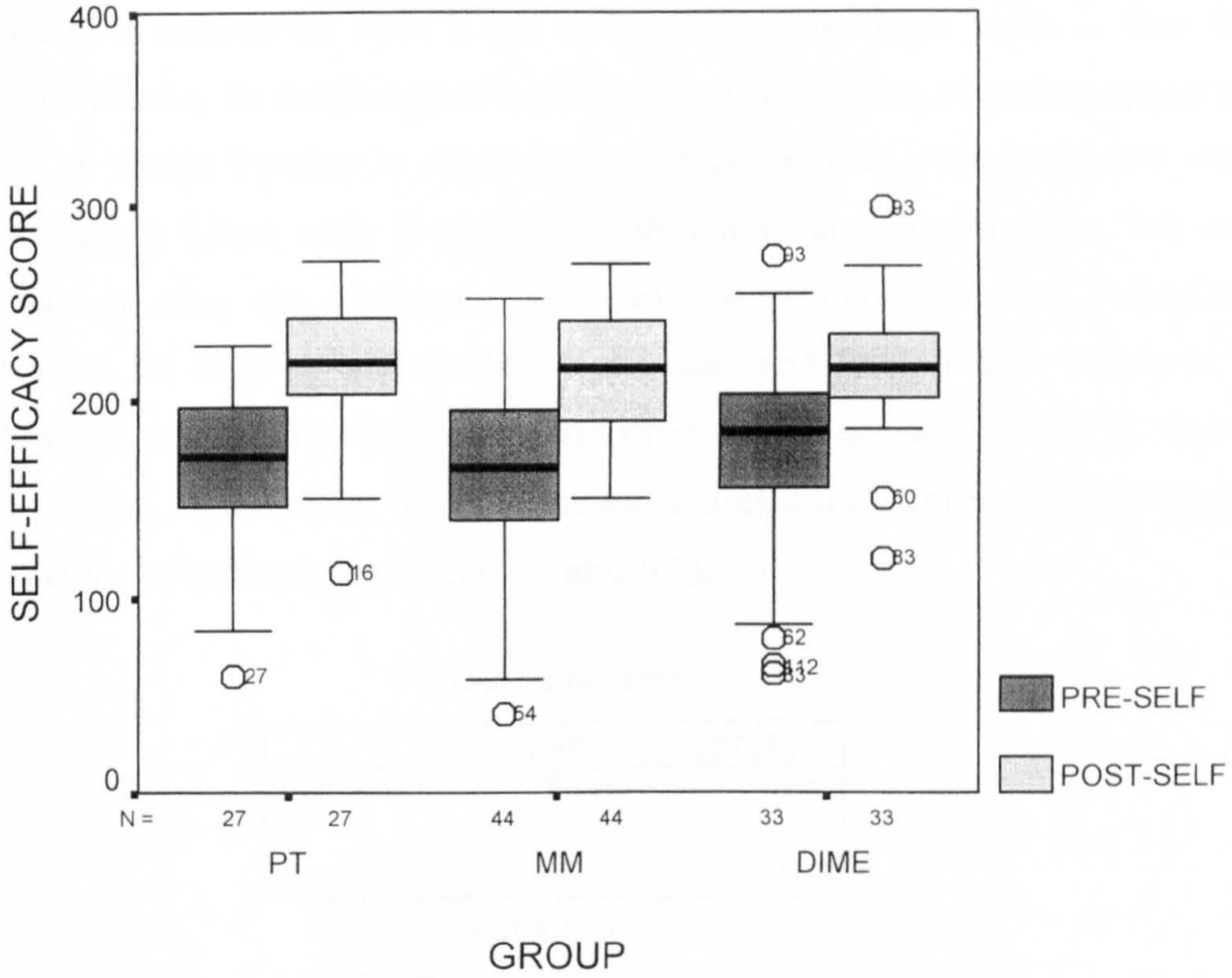

Figure 9.4 Self-efficacy ratings pre and post intervention (SPSS v10)

The Sign test reinforces these findings (refer to Table 9.4).

Test Statistics[a]

GROUP		POSTSELF - PRESELF
PT	Z	-4.619
	Asymp. Sig. (2-tailed)	.000
MM	Z	-5.795
	Asymp. Sig. (2-tailed)	.000
DIME	Z	-4.874
	Asymp. Sig. (2-tailed)	.000

a. Sign Test

Table 9.4 Sign Test: SPSS output

An analysis of individual self-efficacy statements is shown in Appendix I.

Caution must be taken in the application of further quantitative techniques. As Jacobs (1998) states "a judgmental scale is not necessarily a true linear scale ... thus the results obtained may be mathematically valid while not meaning what they appear to suggest". A similar opinion is expressed by Mogey (1998). He states that data collected using a Likert scale is ordinal i.e. they have an inherent order, but one cannot assume that the difference between "no confidence" and "complete confidence" is the same as between "no confidence" and "undecided". However, a Kruskall-Wallis test, the non-parametric equivalent of the one-way ANOVA, shows there to be no significance in the median self-efficacy scores pre and post-implementation of the treatment (refer to Table 9.5).

Test Statistics[a,b]

	PRESELF	POSTSELF
Chi-Square	2.898	.266
df	2	2
Asymp. Sig.	.235	.876

a. Kruskal Wallis Test

b. Grouping Variable: GROUP

Table 9.5 Kruskall-Wallis Test: SPSS output

9.5 Communication behaviours

As Musselbrook *et al* (2000) state "to look simply at specific communication behaviours in isolation from their context and the aims and objectives of the learning task would ultimately be unhelpful". Therefore, the evaluation of computer-mediated communication, in this study, does not merely record student and staff usage data, it also analyses the content of all student-tutor email, fax, telephone and face-to-face contact.

A log of student-tutor communiqués was maintained by module tutors and a brief resumé of the nature of the content was recorded. Tutors received 26, 64 and 72 queries from students undertaking PT (outside evening class sessions), MM and DIME^{PM} respectively. Email was the most popular means of communication (69% PT; 69% MM; 81% DIME^{PM}). 81% of the student cohort made no contact with tutors during the PT delivery, compared to 53% in MM mode and 29% in DIME^{PM} mode.

The increased volume of communiqués associated with distance learning delivery was consistent with the views expressed by academics in Chapters 3 and 5. However, subsequent coding of synchronous and asynchronous communications revealed similar issues arising in all delivery modes. Four categories emerge from an analysis of the content, namely Administration, Guidance, Social and Technical (refer to Figures 9.5 - 9.7). The former comprised a variety of procedural issues such as the confirmation of assignment submission dates, submission of mitigating circumstances and requests for presentation facilities. Guidance focused solely on the Part 2 assignment (refer to Appendix E) as further assistance was sought regarding work breakdown structures, networks and specific project parameters.

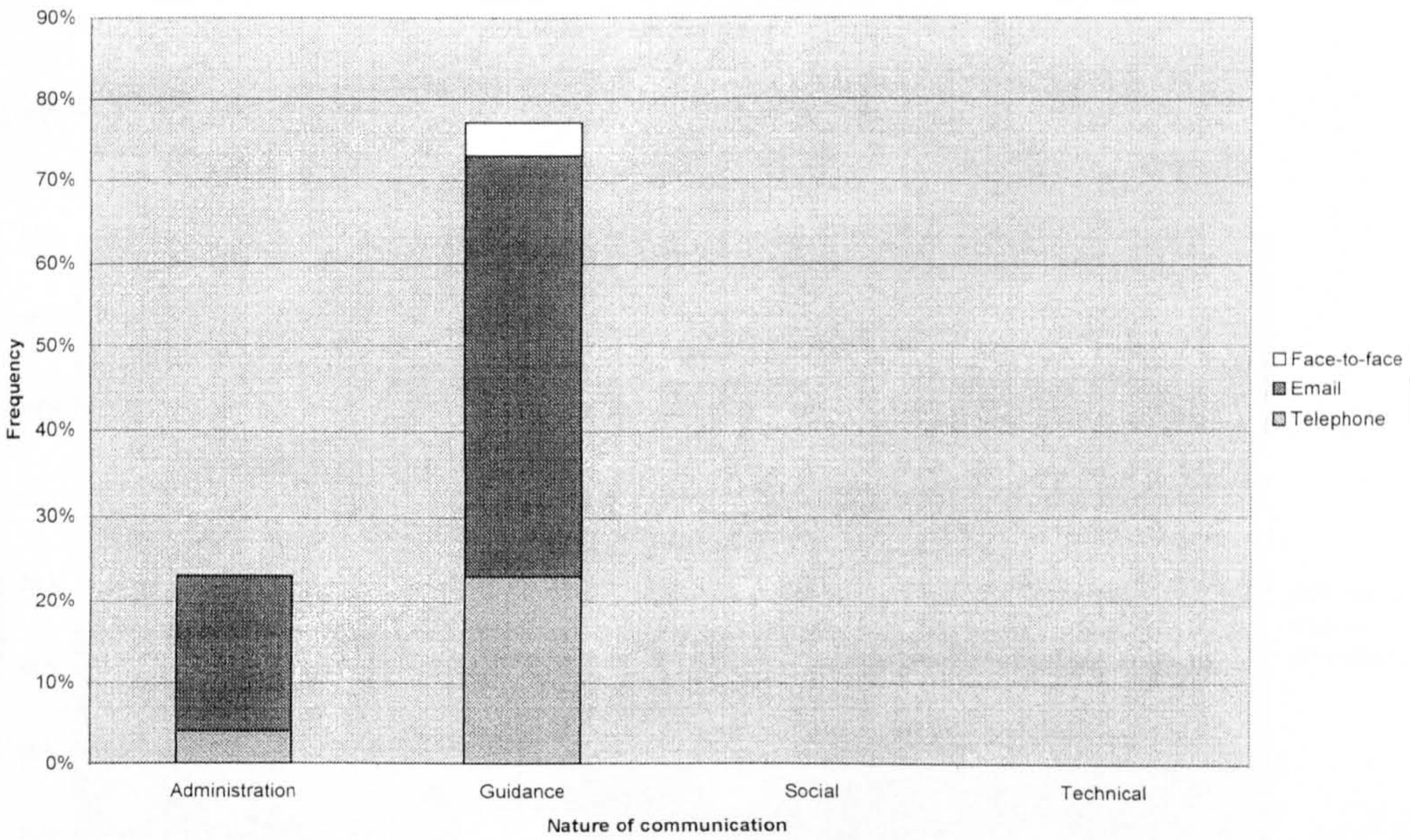

Figure 9.5 Part-time student-tutor communication

The Social category was an eclectic mix of progress reports and casual reflections on the learning taking place. For example:

> *... so far the course is going ok (I think!!!!!). I have actually tried to apply some of the theory in the work environment. Lets just hope I don't get sacked!* [44]

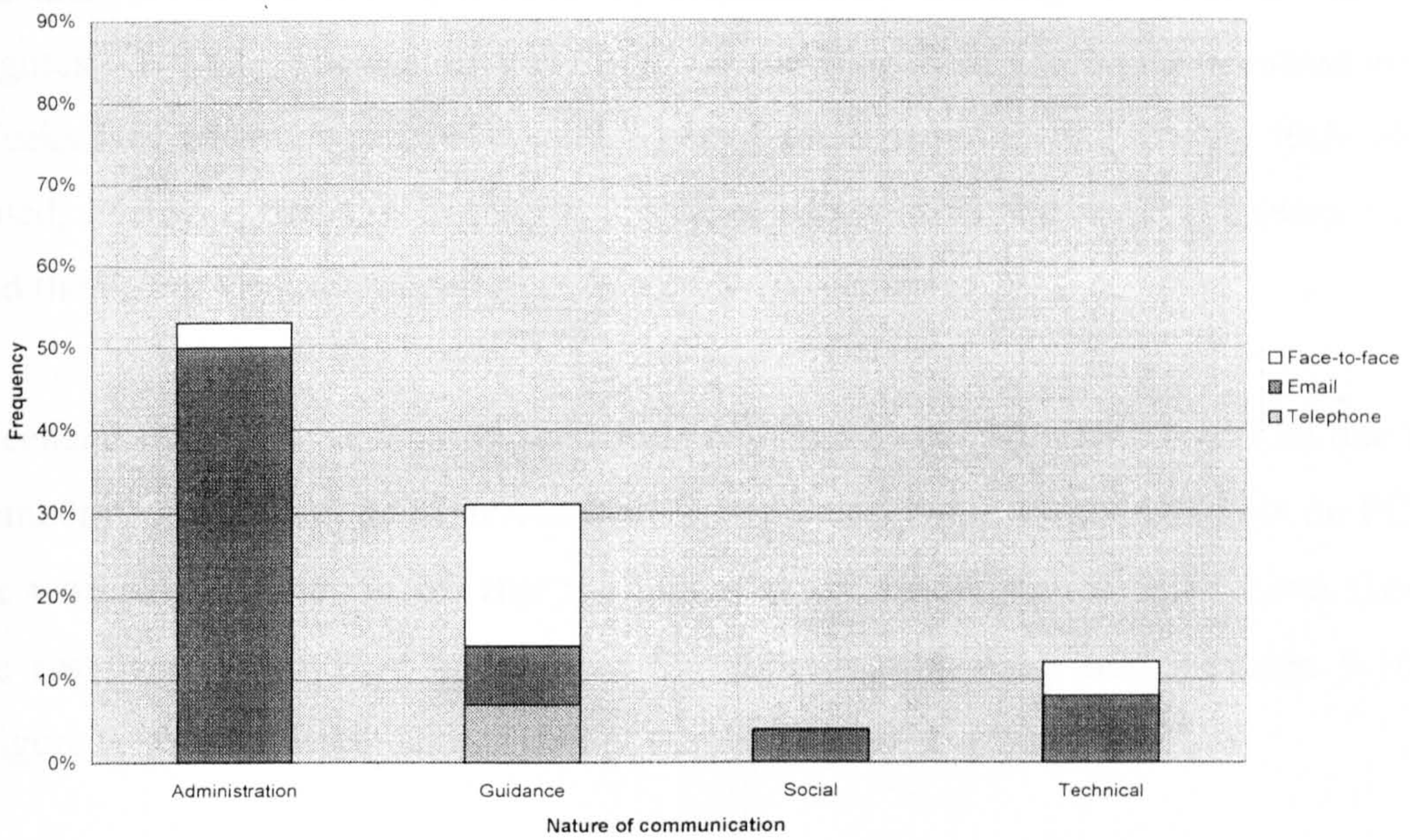

Figure 9.6 Multiple-media student-tutor communication

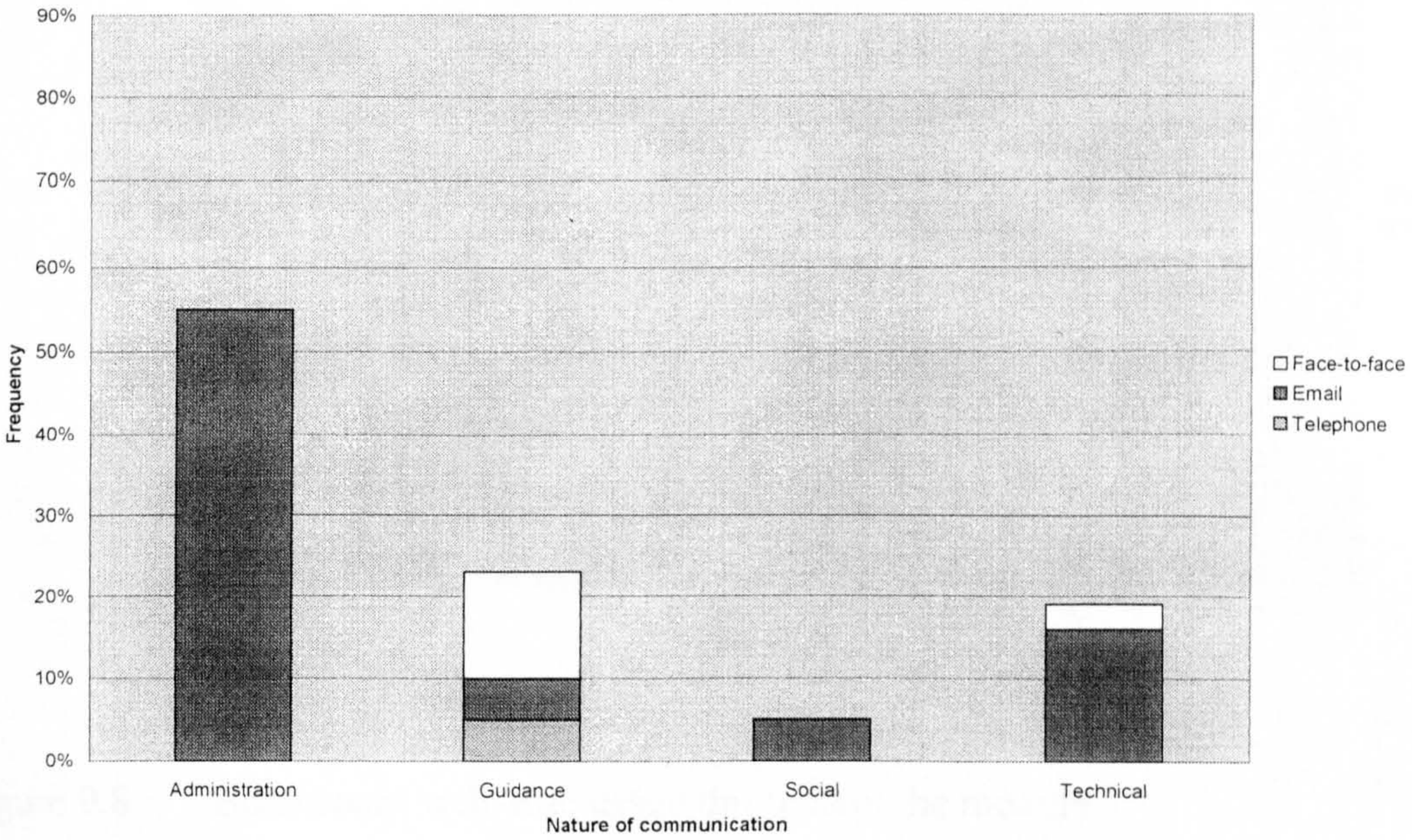

Figure 9.7 DIME^{PM} student-tutor communication

Technical queries, however, were very much dependent upon the delivery mode. Issues related to audio and video tapes, and the CAPM demonstration disk arose in MM delivery whereas the operation of the CD-ROM attracted comment from DIME^{PM} students. Here the issues related to specific web pages, "Blackboard" log-on procedures and software/hardware queries regarding the playing of video sequences. There were no technical issues associated with PT delivery.

An analysis of the data generated by Blackboard's tracking facilities is shown in Figures 9.8-9.12. The majority of "hits" on the Blackboard web-site occurred during Weeks 1-11 of semester 1 (94%) and Weeks 1 to 10 of semester 2 (81%). It should be noted, however, that the Christmas vacation occurred in Weeks 12-14 (semester 1) and the Easter vacation occurred in Weeks 8-10 (semester 2).

Weekend use (23%) did not exceed weekday figures (67%). This could be due to a number of factors e.g. that Internet facilities were available to students only on PCs in the workplace/on-campus or that the inclusion of Administrator "hits" have skewed the results. The most popular time for accessing the web was between 9-10pm (Figure 9.10 amended to show GMT).

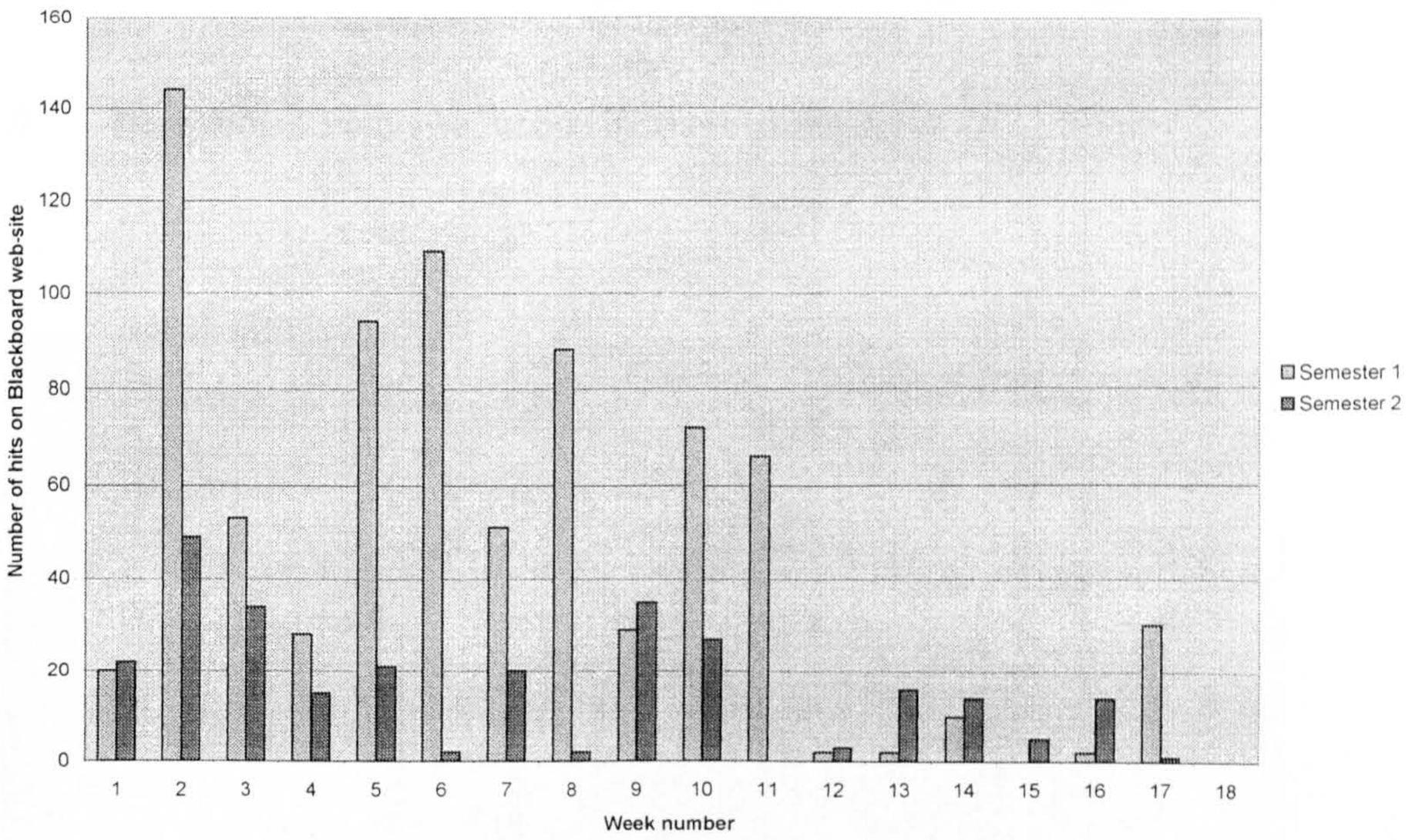

Figure 9.8 Blackboard web-site: usage throughout the module

Although Blackboard tracking was unable to schedule the access times of individual students, it did allow individual student/administrator usage of web-site facilities to be monitored (refer to Figure 9.11). 52% (17) of the DIME^{PM} group accessed the web-site. Overall usage figures (refer to Figure 9.12) revealed that Course Documents accounted for 28% of student "hits", Assignments 23% and External Links 14%. The Main Page together with Course Information and Staff Information constituted a further 10%.

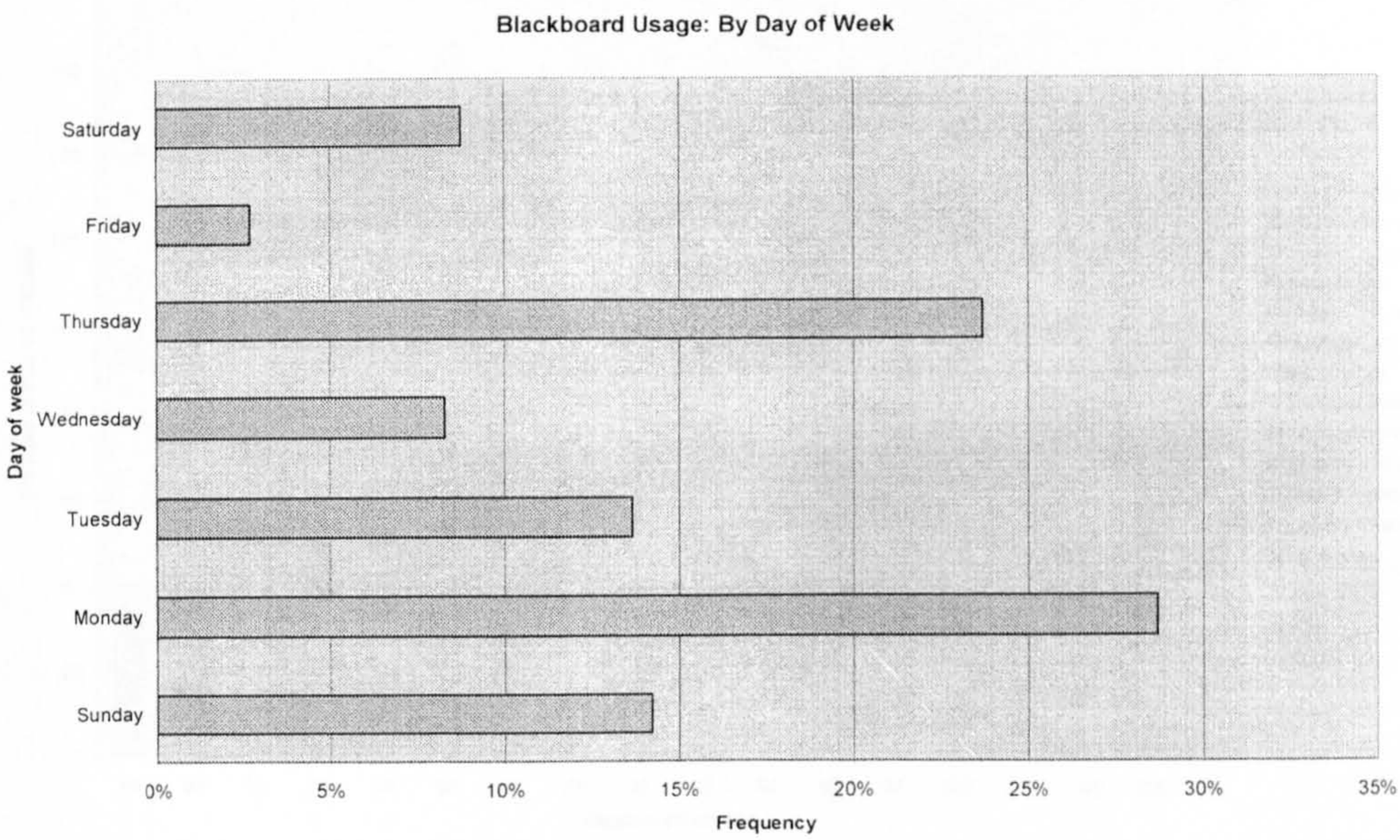

Figure 9.9 Blackboard web-site: usage by days of the week

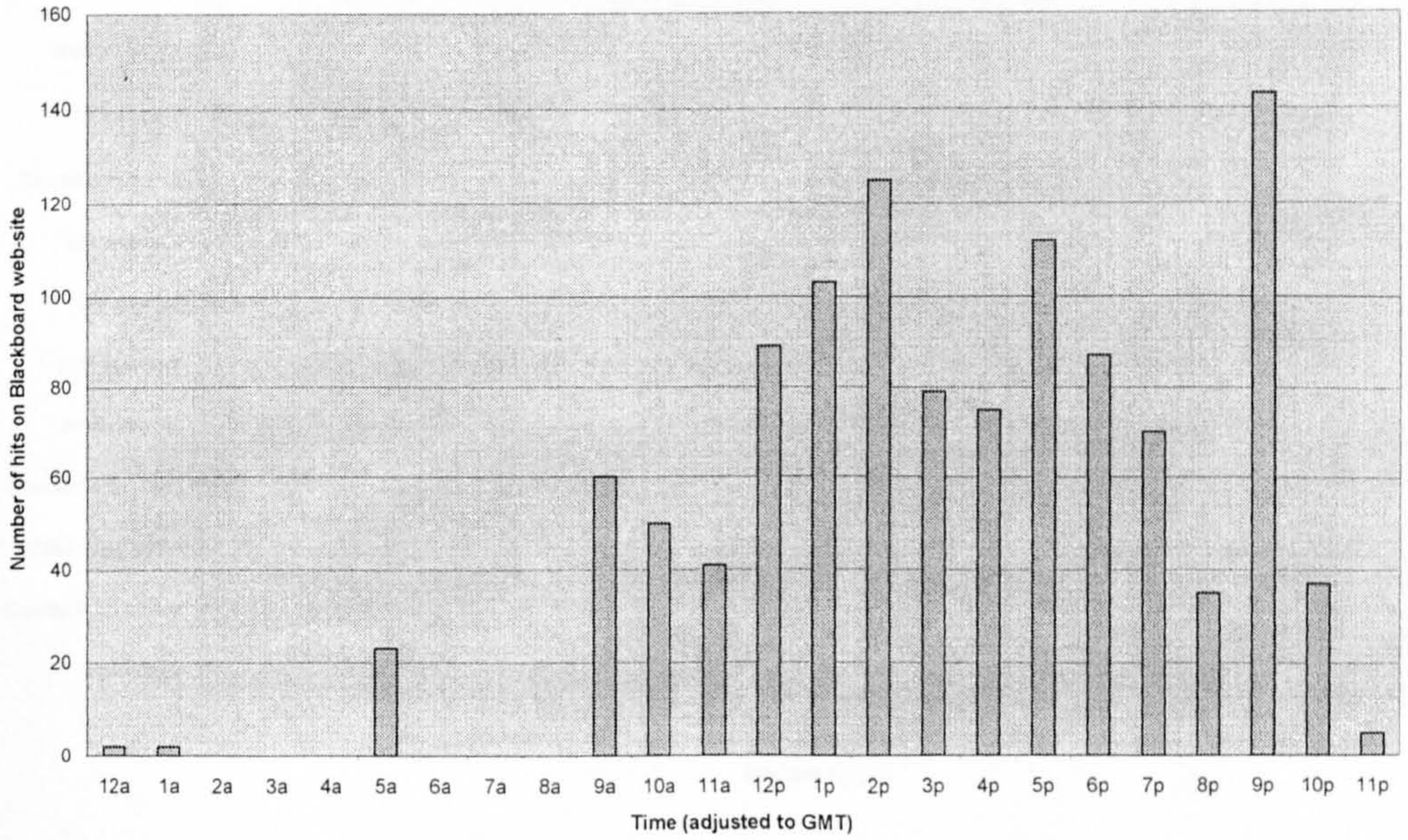

Figure 9.10 Blackboard web-site: usage by hour of the day

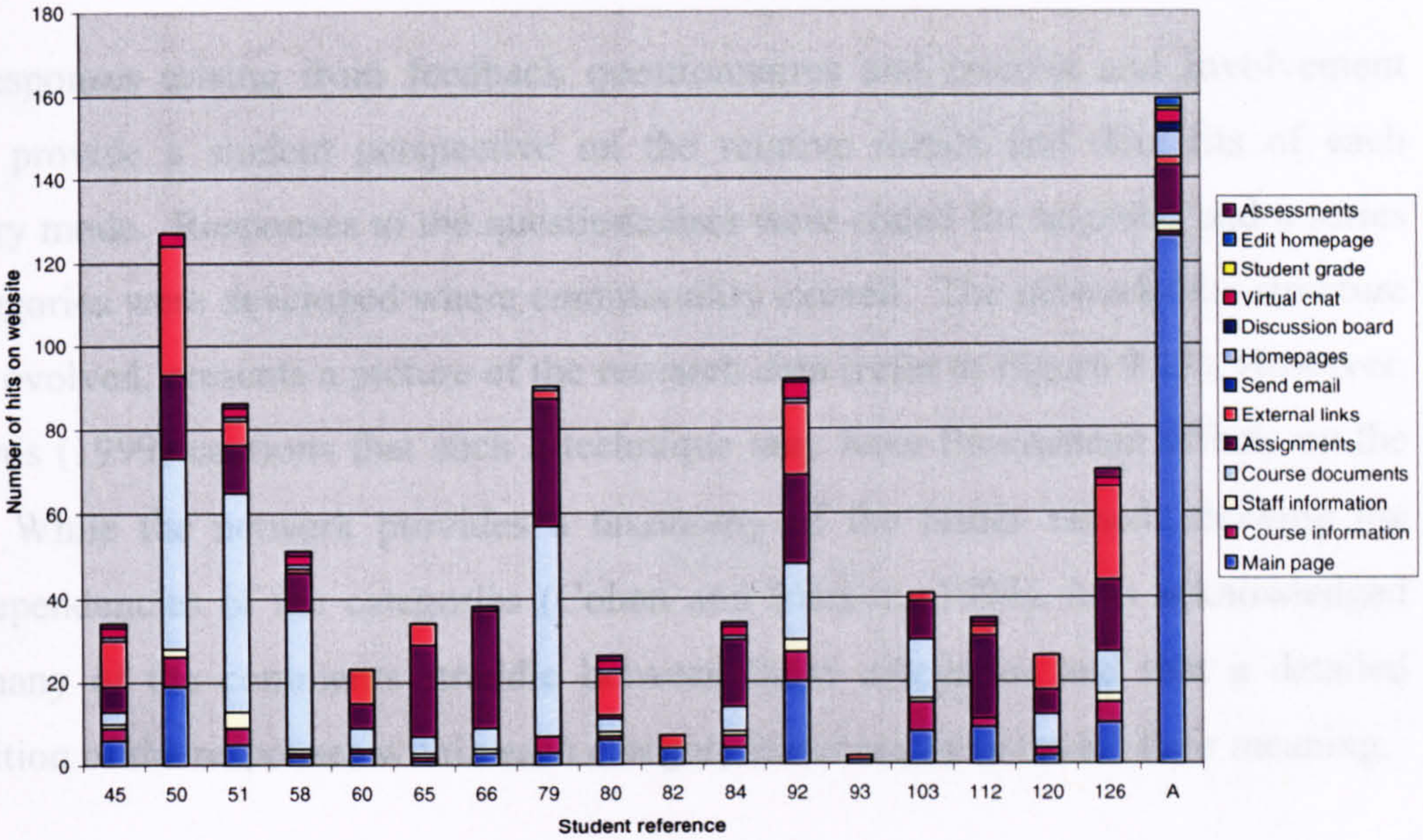

Figure 9.11 Blackboard web-site: individual student usage

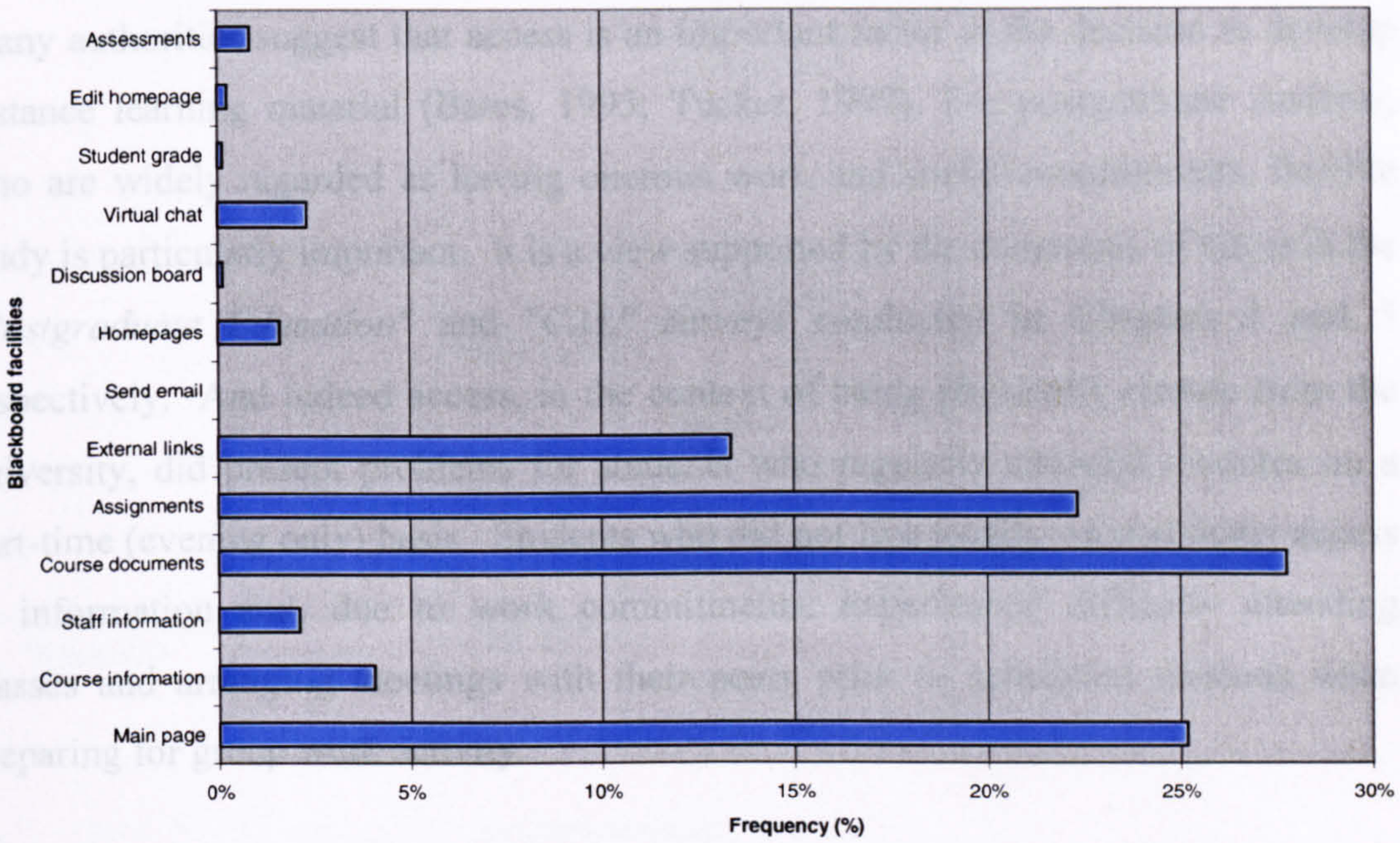

Figure 9.12 Blackboard web-site: facilities used by students

The facilities geared toward synchronous and asynchronous communication were seldom if ever used. Students did email tutors, although not through the VLE. Despite encouragement to communicate with tutors there was no attempt to use the discussion board. Discussion threads posted by tutors did not prompt further comment.

9.6 Student reaction

The responses arising from feedback questionnaires and Interest and Involvement charts provide a student perspective on the relative merits and demerits of each delivery mode. Responses to the questionnaires were coded for meaning and a series of categories were developed where commonality existed. The network-like structure which evolved, presents a picture of the research data (refer to Figure 9.13). However, Richards (1999) cautions that such a technique may have Procrustean effects on the data. While the network provides a taxonomy of the issues raised, showing the interdependencies of the categories (Cohen and Manion, 1994), it is acknowledged that many of the comments straddle between these categories and that a detailed exposition of the responses within each category is necessary to reveal their meaning.

9.6.1 Learning Resource

Many authorities suggest that access is an important factor in the decision to develop distance learning material (Bates, 1995; Tucker, 1997). For postgraduate students, who are widely regarded as having onerous work and social commitments, flexible study is particularly important. It is a view supported by the comments of tutors in the "*Postgraduate Education*" and "*CAL*" surveys conducted in Chapters 3 and 5 respectively. And indeed access, in the context of being physically remote from the university, did present problems for students who regularly attended modules on a part-time (evening only) basis. Students who did not live locally wanted better access to information and, due to work commitments, experienced difficulty attending classes and arranging meetings with their peers prior to scheduled sessions when preparing for group work activity.

> *Unfortunately I have missed a large percentage of the module due to work commitments* ... [26]

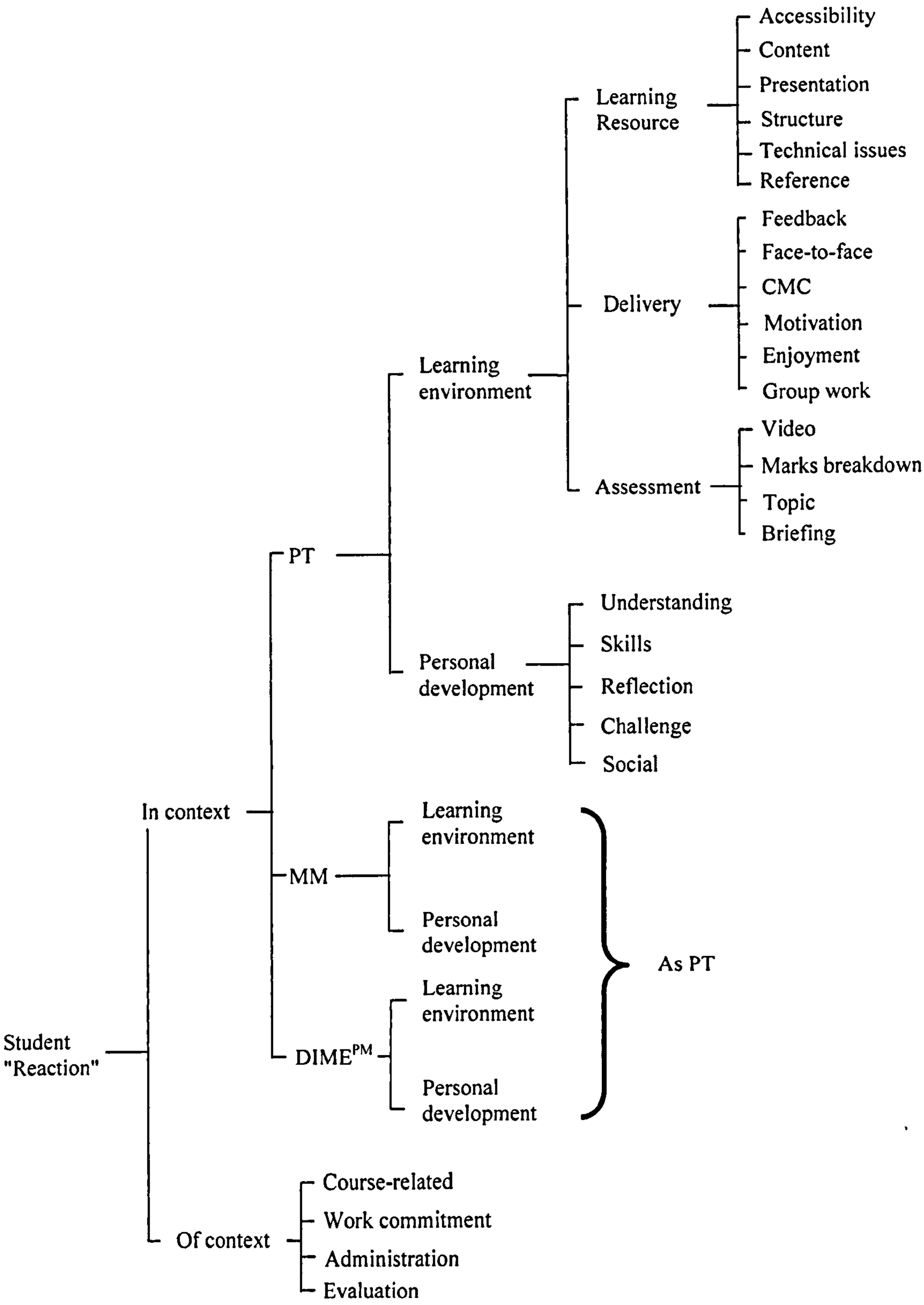

Figure 9.13 Network analysis: student "reaction" to Project Management delivery

The part-time programme was perceived by two students to be slightly haphazard. Greater attention was required on briefing students prior to forthcoming lectures so that they could prepare beforehand. Conversely, many students stated that the course was well structured and organised.

The supporting study guide was also commended for its structure and as a summary of the issues discussed, but it was perceived by one part-time student to be a distance learning package which relied heavily on access to the library. Four students wanted more handouts and there were also specific requests for additional information concerning project management contracts, procurement systems and project management techniques.

> *Because it is a sort of "read" module, it should be stressed at different stages where the student should have got to in terms of own study. I know at MSc level we shouldn't need to be spoon fed but a review would be useful.* [11]

Similar requests were received from students studying in distance learning mode. Additional information on project management methodologies and linear responsibility charts were required together with more software package awareness. Unlike part-time delivery, however, the appropriateness of presentation and communication skills in a distance learning module was questioned. The study guide was construed as being "text orientated/lifeless" and it was recommended that more use should be made of video for human interaction aspects of the course.

> *I wonder whether "presentation skills" can be developed/improved as part of a distance learning course.* [56]

The multiple-media version of the learning resource tackled the same topics as those studied by their counterparts, but here a range of video, audio and software applications complemented the text-based materials.

> *The books, video and tapes were very good and very stimulating.* [54]

The variety of media met with a mixed response. Although the multi-media resource was favourably received by the majority of students, others found the video tapes and audio tapes less rewarding. The following comments illustrate this dichotomy of view:

> *The audio tapes were interesting and added variety to the way teaching material was delivered.* [57]

> *Lecture audio tapes - I personally found these difficult to learn from.* [31]

The design and presentation of the handbook enhanced the distance learning experience and was acknowledged by two students as providing useful reference material for future use. Students appreciated the structure of the module and considered the time-scale in which to digest the material was realistic.

The structure enabled some students to work through the resource with ease as each Unit "developed on other previously mentioned areas into a more structured understanding" [109]. Others struggled. Without the structure of the time-tabled classes, three students suggested that the study guide should have had a more detailed index and that "major references" to texts should be incorporated in the reader. This was in contrast to the on-line journal references which were perceived to be important and "easy to look up/obtain" having once gained ATHENS authentication. These procedures were perceived to be overly complicated, students having first to register on FirstClass email and await their password and ID.

The content and presentation of DIME^{PM} received favourable reviews. Material was typically regarded as being of a very high standard and the "simplicity of menu control, the search capability of CD together with links to other data" [51] further enhanced the usability. Many students commented on the user-friendly nature of DIME^{PM}.

> *The CD-ROM was particularly user-friendly and was helpful in respect of the module assessment.* [120]

On student went further:

> *The CD is terrific and I find myself enjoying the learning process.* [65]

Clear, progressive presentation of Units aided by practical examples was acknowledged as a positive attribute.

> *The holistic nature of project management was brought together well - not just planning or risk management, but overall control.* [115]

But the Unit/Topic approach also tended to make the text fragmented and it was suggested that summary text addressing the key issues should be included. Greater clarity was also required to help students gauge their progress.

The functionality of the CD-ROM was preferred to the Blackboard facility.

> *CD delivery compared to Blackboard is really easy. You can flick to wherever you want. The CD is a far better way of doing it.* [45]

However, some students felt that computer-aided delivery, whether it was stand alone of web-based, inhibited access to the learning materials. Students might, for example, study on the train or at work, where Internet access was problematic.

> *...I would have gone for the hard copy of the course notes purely so I could have had it to hand all the time and not needed to have been at a P.C..* [50]

> *As a working mum with two children it's difficult to get on the computer - the children always want it.* [126]

A number of technical issues associated with the operation of the CD-ROM created problems for students. Although the Blackboard web-site enabled students to download and print learning material, this facility was not available directly from the CD-ROM. In one case this had clearly affected the learning experience.

> *Last weekend I worked my way through a Unit on the CD and I was quite worried how little I retained in comparison to my regular learning methods, which involve a lot of colourful notes in the margins of books ... summing up in my own words. This is my first experience of learning software and while I enjoy the interactive parts and the audio/visuals on tap, on balance I don't think it's for me, especially because I cannot print out parts that I need to ponder over or "visually enhance" for memorising.* [126]

Improved "Notepad" and bookmark features were needed. Response time was regarded as being slow, therefore a facility to be able to print documents directly from the CD-ROM, rather than from Blackboard, was requested.

9.6.2 Delivery

Module delivery attracted much comment. 55% of students in distance learning mode made some comment regarding the success of the induction workshops. Typically tutors received praise for their success:

> *Staff passed on their enthusiasm both in the face-to-face session and in the compilation of material.* [56]

However, there was demand for longer induction sessions and additional workshops throughout the module. Students making use of the multiple-media resources requested more contact either by regular lectures, interim tutorials or surgery sessions. The reasons for this were not always apparent in the responses but it did seem, in part, that these measures were perceived as a way of maintaining student motivation.

> *When under pressure in full-time employment education unfortunately takes 2nd place. Regular lectures and the preparation of course work, focus the mind.* [76]

Despite such criticism there was much praise for the feedback students received.

> *Whenever I emailed or rang for help, help was readily available and the answers useful.* [57]

A mixed message was received regarding the feedback received by students using the CD-ROM. Although students identified the dialogue and support given by tutors as a strength, there were, once again, demands for greater contact with tutors.

> *Prompt responses to questions/clarification issues from tutors* [61]

Despite encouragement from tutors, the CMC capabilities of the hybrid CD-ROM were not used by students (refer to Section 9.5). Clearly, this reduced opportunities for dialogue with tutors, but it also precluded on-line discussions between students. Those who expressed a willingness to use the facilities were in the minority i.e. two students, and were frustrated by this lack of interaction.

> *I was unhappy that there was not more use made of Blackboard etc. Talking to other students would have helped. I think that networking with others should be made part of the assignment. For example, do a joint value management exercise (at least virtual).* [126]

The demand for feedback was seemingly inexhaustible, irrespective of the delivery mode. While formative feedback from lecturers was helpful, whether this was in "class" or in individual tutorials, further guidance before the presentations, additional briefing for the assignment and individual feedback on assessed work was requested from students undertaking the part-time mode.

Interest, enjoyment and fun were generated by the part-time debate sessions and the "friendly" relations between tutors and students was appreciated.

> *Debate situation - with people firing questions depicted a good work environment.* [18]

Similar reactions were also as a direct consequence of the module tutors' enthusiasm in the subject, visiting lecturers and the spread of subjects. The communications lecture was particularly well received. Guest lecturers were welcome as they provided variation to the general delivery style and the variety of subjects was appreciated.

Clearly, personal learning styles and student familiarity with the subject matter were factors that affected interest. One student, studying in multiple-media format states:

> *As a slight introvert I tend to shy away from personal interaction and tend to like the technical aspects of the module. I really enjoyed the material and the distance learning presentation was interesting and stimulating.* [54]

Likewise, the perceived relevance of the subject affected interest. Another student also undertaking the multiple-media mode, stated that he was interested in the practical skills but had little patience with interpersonal aspects of the module. This view was not shared by all:

> *Communication is my highest interest within a project because it is the basis of a good brief.* [125]

The relative interest generated, therefore, by the topic areas was mixed. Some students struggled with the Value Management and Risk Management topics, enjoying the "nuts and bolts" of planning and communicating while others stated that their interest was affected by the need or opportunity to apply them to problem scenarios. Distance learning was a contributory factor.

> *Some of the material, by its nature is hard to digest. This is more relevant to [a] distance learning course because of the lack of contact between the student and university ... perhaps a CDRom based tuition system could be useful.* [89]

Student reaction to the content in DIME^{PM} was again largely dependent upon individual preference. For some the material was interesting and stimulating, motivating study.

> *Value management is of particular interest due to government policy on "best value" in central (and local) government departments (I work as a civil servant).* [115]

However, where interest and motivation was a problem, distance learning, rather than the nature of the learning resource was perceived to be the root cause.

> *It has been difficult to maintain an interest due to it being distance learning and was always put on a lesser priority to the modules based o regular on-going attendance.* [87]

> *I personally found it very difficult to motivate myself sufficiently in a "distance learning" environment. I found my other modules taking priority due to the weekly attendance schedules.* [95]

Interactive exercises were similarly complimented as were the self-assessments. Expressions of interest and enjoyment were limited, but where such statements were expressed they were linked to the interactive aspects of DIME^{PM} delivery.

Group work, in some form, was commented on by all students as being a positive aspect of part-time delivery. Such activity had a threefold benefit, namely "to put the point across" [5], to enhance "team-building" [30] and from a social perspective "to get to know others on the course" [9]. Furthermore, students found it beneficial to work with their peers on other courses.

However, mixing cohorts in delivery sessions did heighten student concerns regarding the relative knowledge of the groups and the apparent lack of cohesion within cohorts.

> *Felt that I was initially at a disadvantage as students on other courses already knew one another and were familiar with working together.* [10]

Team-working and subsequent presentations were found to be "very interesting and enjoyable, particularly in an evening following a days work" [23]. But the bias toward group activity was, on occasion, perceived to be too pronounced. Four students suggested that more time should be devoted to lectures.

> *More background information/examples before progressing onto the "team activities".* [5]

In order to investigate further the interest engendered by the module, however, students were requested to complete an Interest and Involvement chart during the course of their studies. The mean scores for each topic are shown in Figure 9.14 (MM n=19; DIME^{PM} n=7; PT n=4).

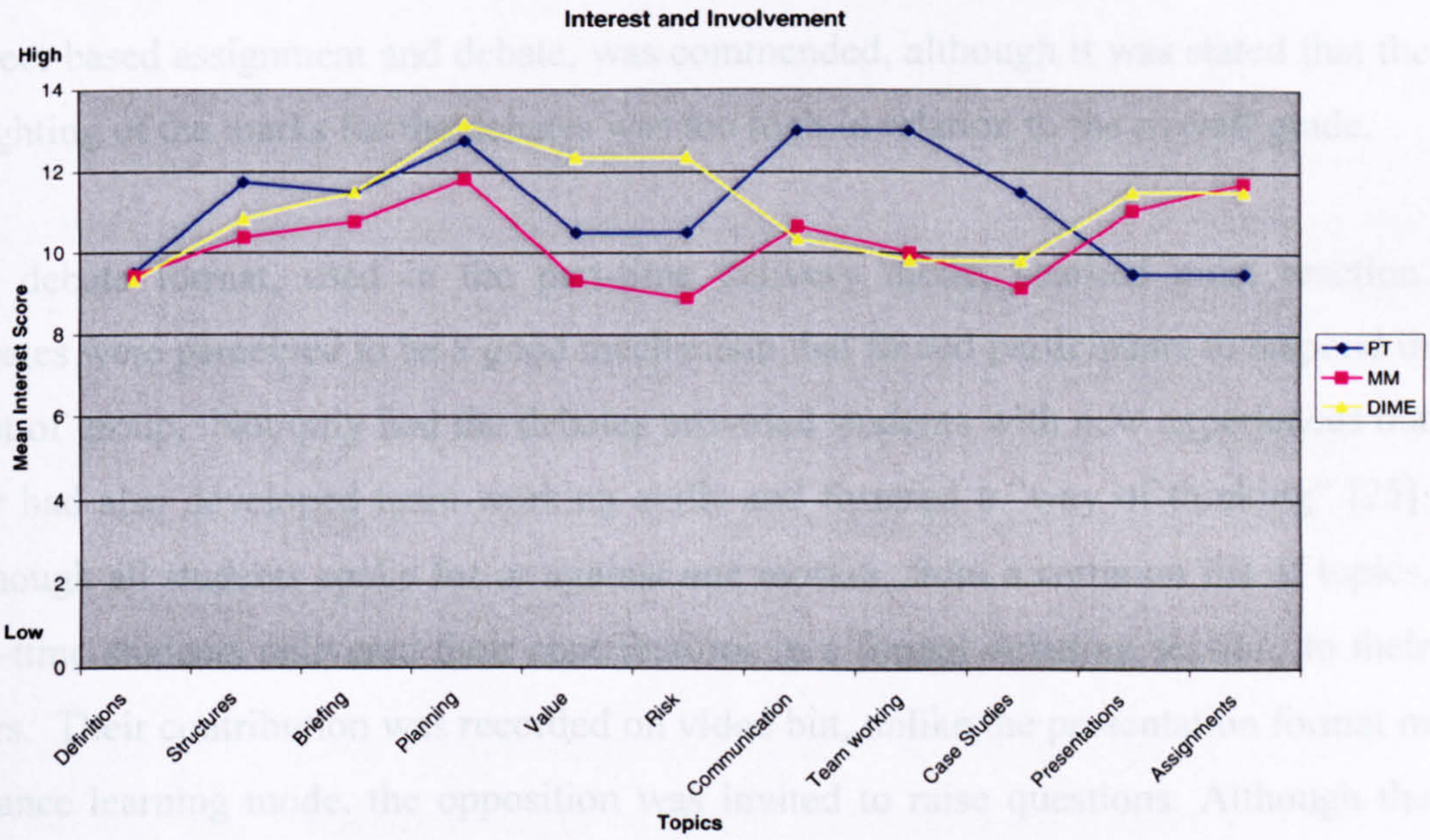

Figure 9.14 Interest and Involvement chart

Although there is no intention to apply statistical tests to these results (refer to Section 9.4), it is submitted that the chart reveals some important issues that support the findings from the feedback questionnaire. Namely, that "soft" issues were particularly well received by PT students and that the "hard" issues lent themselves more readily to distance learning delivery.

9.6.3 Assessment

Clearly the challenge created by the module assessment i.e. the project and presentation/debate, was demanding (refer to Appendix E). This was exacerbated by distance learning delivery.

> *I was quite interested in doing both the presentation and assignments. It was very difficult for me though quite challenging - took a lot of time, more than the modules you are required to attend classes.* [114]

Reaction focused principally on prosaic issues such as the problems associated with video presentations, marks allocation between the two assignments and the choice of topic. Not surprisingly, some students found that they were more able to cope with the mode of assessment i.e. coursework, rather than examination. Others felt an examination should be set. However, the coursework component, combining a project-based assignment and debate, was commended, although it was stated that the weighting of the marks for the debates was too high in relation to the overall grade.

The debate format, used in the part-time delivery mode, sparked most reaction. Debates were perceived to be a good mechanism that forced participants to respond in front of group. Not only had the debates provided students with new experiences but they had also developed team-working skills and fostered a "way of thinking" [25]. Although all students spoke for or against one motion, from a common list of topics, part-time students delivered their contributions in a formal debating session, to their peers. Their contribution was recorded on video but, unlike the presentation format in distance learning mode, the opposition was invited to raise questions. Although the majority of students who passed comment on this approach were strongly in favour of the format, others were vehemently opposed to it.

> *Presentations are a pet hate, although I am aware that they are an important and inevitable part of working life.* [14]

In multiple-media format, the video presentations were considered to be an unusual but testing assessment method. Again favourable reaction to the use of video was not shared by all. A greater choice of topics was recommended, some students wanting a free choice of project, some preferring that presentations be delivered "live". There was also some cynicism regarding the approach being used.

> *Video presentation - why, really beneficial or used as part of the whole multimedia experience?* [104]

The majority of students, when making reference to learning, did so in the context of the assessment components. Typically:

> *I really enjoyed researching for the presentation which gave a good understanding of project management.* [118]

Assessment benefited from a realistic and relevant "case study" approach. Varied media was regarded as a good idea. There were also requests for including further video materials e.g. the London Eye project, in the learning pack. One student suggested that they should have been involved in running a project so as to get first hand experience. But in order to maintain interest and gain formative feedback, it was frequently suggested that assignments should be shorter and submitted more frequently during the module. Both the assignment and presentation had been challenging, requiring a "significant" amount of time to complete. Submission of both assessment components at the end of the module increased further the need to adopt a disciplined approach to study.

Similarly, DIME^{PM} students requested greater freedom in choice of assignment topics. They too felt that assessment should be spread throughout the module and that an interim assessment would help with the programme of work.

> *More flexible hand-in dates. Majority of students on this course work full-time and more!* [65]

The design of the assessment was also queried. One student felt that assessment should reflect all the content contained on the CD-ROM. Motivation, clearly was linked to the specific tasks, as was learning. The following comments were typical:

> *The presentation and assignment have helped me understand and appreciate a lot of the finer details of PM [project management] as well as giving me an opportunity to put them into practice.* [112]

> *An examination would force students to delve deeper into the reference literature.* [124]

> *My level of interest in the case study, presentation and assignment were naturally high, since the successful grade depended upon application of these key elements. Teamworking was lowest since I already have some experience in that regard. The others varied, not because of any deficiency on their part, but to some extent depended on how interesting I perceived them to be.* [101]

Beyond that, the content on DIME^{PM} was very much a secondary consideration. There is a dilemma here. The view that postgraduate education should not be driven by assessment is brought into sharp focus. Unquestionably the assessment tasks should relate closely to learning outcomes (QAA, 2000). Whether it is used as a "stick" to force students to pursue every facet of their studies is a matter for debate.

9.6.4 Personal development

Students reflected on the skills they had acquired during the module. Interestingly, the mode of delivery had had a direct and indirect effect on these skills. For example, research methodology was perceived to have been improved due to the fact that the module was delivered in distance learning format. Experimentation with project management software had also enhanced computer skills. Indirectly, distance learning encouraged students to improve their discipline in pursuing academic study.

> *It forced me to work harder to find out things for myself instead of using the lecturer as a crutch.* [101]

> *... the module forces you to engage yourself even though there are no classes. You have to discipline yourself to work on it.* [114]

Moreover the technical expertise of students in the application of network analysis had improved. Relevance to the work place activity was regularly commended:

> *I gained a good understanding of CP [critical path] methodology that will help in day to day work.* [115]

> *The module did give me new ideas about how to do things at work.* [57]

Other students perceived distance learning to be a barrier to learning.

> *Even though this has been a distance learning unit - I feel as if I have reached the unit objectives and gained new knowledge.* [97]

In part-time mode the majority were favourably disposed to the delivery. Yet the module did provoke quite different reactions:

> *It has been a well presented course which has encouraged participation. I have found little to fault.* [9]

> *Didn't feel I learnt anything from the module or that it had any relevance to the course I'm on. Nor was it interesting.* [16]

Such diverse opinion can bring into question the value of evaluatory studies. Clearly there are other influences at work here which stem from the individual or the context of the study.

9.6.5 Evaluation "of context"

It became apparent during the analysis of the feedback questionnaires that the learning experience could not be divorced from issues external to module delivery. Institutional issues such as remote access to electronic journals and course organisation had affected students. The latter seemed to have exercised students most. As such, many of the issues raised were independent of the mode of study.

Limited choice of elective modules and the juxtaposition of project management within the course influenced motivation and, in some cases, had reduced the time students might otherwise have devoted to their study. Issues raised included the position of the module in the overall structure of the course, the lack of elective choice, and the relative "effort" put into the module. The interest in the module, it was observed, must be "put in context" - students who were 18 months into a two-year course faced "the prospect of a triple module dissertation hanging over us". This student continued:

> *Student/staff interaction is limited and feedback is given after the module has finished. Students feel/are isolated, feel they have to "slog it out" and get as good a mark as their own personal characteristics will permit.* [77]

Not only was interest affected by the position of the module in the course, it was also affected by the timing of the assignment within the module.

> *As usual, I cram a lot of reading into the first few weeks, then lose interest to a certain extent, prior to cramming lots of work into the final few weeks before assessment.* [9]

The culture of each course had also influenced student expectations. For example, the lack of cohesion within the cohort, for one student, ensured that greater effort was invested in study:

> *On our particular course group participation is sadly lacking, so gave me more encouragement to work harder for myself.* [109]

Most students in full-time employment had arduous work commitments and were keen to see greater flexibility, not only in delivery but also with regard hand-in dates for assignments.

A common administrative issue focused on the limited lead-in time to the module, which reduced the time available to gain the necessary research material. Other course-related issues, as opposed to particular features of the Project Management module, concerned concurrent delivery of other modules and their impact on study time.

> *In the spirit of project management, the two modules have been "jostling" for priority, which at the time makes it a struggle, but on reflection makes you plan it, control it and do it!* [61]

Although the intention was that the evaluation procedure should "look in" on the process, student perception was quite the contrary. The pre-test received much criticism. Unlike other evaluation tools the assessment-style format proved to be both unsettling and demotivating to students and had, for some, made the module as a whole less enjoyable. One respondent stated:

> *To start the module with a test (despite its purpose) ... just showed how little I knew, was entirely demoralising and removed any initial enjoyment in starting the new module.* [57]

These reactions were common with those reported by Shinkins (1995). Clearly, reassurances that the pre post-test evaluation was to be used solely to inform the development of a School-wide LTA strategy and for personal research purposes, had not overcome these difficulties. Two students felt that too much emphasis had been placed on self-efficacy.

> *I'm afraid at 46 I am possibly a bit too old and set in my ways to analyse my ... self efficacy!!* [43]

The validity of the experimental approach was also brought into question by one student, who stated:

> *I used the book for the module but I heard a fellow student who had used both the book and the CD speak quite favourably of the latter. Both should have been issued.* [101]

This was a worrying finding. Despite having issued students with either the multiple-media pack or DIME^{PM}, it was not possible to police students so as to ensure that sole use was made of the resource they had received directly from the tutor.

9.7 Summary

Student academic performance and confidence in undertaking related tasks increased in all Project Management delivery modes on completion of the module. However, no statistical difference was found between the control and experimental groups. Qualitative analysis of student reaction, however, uncovers issues that reflect many of the concerns raised by the academic community in Chapters 3 and 5. Namely, that a lack of motivation and face-to-face contact with tutors are common problems for many distance learning students. Distance learning study, in whichever form, requires greater discipline from the learner.

Arguably the cornerstone of web-based delivery lies in its inherent ability to enhance access, to breakdown the "distance" in distance learning delivery and offer an anytime/anywhere solution to educational needs. If so, then the reaction of students during this evaluation conflicts with the popular view. Work commitments reduced the "window" available for study and for evidently "mobile" students Internet access was not always practical or possible. The advantages of using Blackboard as a VLE were limited. The site neither encouraged dialogue nor did it provide an easily navigable means of accessing the source material.

It is suggested that this was in part a design flaw in the pedagogic approach to the module. Tutors should provide a catalyst for its use, either through formative or summative assessment.

DIME^{PM}, however, did enable students to navigate their way through the resource and, while not without fault, seemed to offer a structured approach to learning. Problems were commonly associated with technical matters. Sometimes these were related to platform performance, elsewhere they were perceived design flaws e.g. inadequate book-marking and print facilities.

The delivery of technical subjects appears to generate similar levels of interest and involvement in all groups but part-time students are noticeably more interested in the interpersonal skills element of the module than their peers, multiple media being least able to stimulate interest in this area. Indeed students question the appropriateness of including communications within a distance learning module.

The interest and involvement in DIME^{PM} reflects Adams' (2000a) contention, in that interest was at its highest when addressing "hard" technical issues and fell away when "softer" aspects were introduced. The module, in all modes, was perceived to have developed skills and understanding. However, student reaction to part-time delivery tended to focus on the benefits of team building skills and group dynamics. There were overlaps here with social issues, as students enjoyed meeting colleagues on other courses. At times this appeared to heighten tensions regarding students' relative understanding of the subject matter, but in general the approach was favourably received. Part-time delivery seemed to be a more "risky" delivery mode. Students often held polarised views of their experience. There were expressions of "enjoyment" and "fun". Others found it irrelevant and dull. Neither extreme was apparent in the MM mode and only seldom were they evident in DIME^{PM}.

The evaluation findings reinforce the view that experimental approaches are affected by external variables and that an evaluation "of context" is vital to gain an in-depth understanding of the issues affecting the effectiveness of CAL. To gain further understanding of these factors in the work place, an illuminative evaluation of DIME^{PM} is discussed in Chapter 10.

Chapter 10

An evaluation of DIME^{PM} in an industry setting

10.1 Introduction

Investment in CAL is inevitably constrained by demand and the projected income arising from the distribution of educational programs. Although the cost effectiveness of CAL is beyond the scope of this research, the high cost associated with multimedia development has been acknowledged (refer to Chapter 1). Flexibility therefore is an essential pre-requisite of multimedia development. This imperative and the seeming reluctance of the construction industry to embrace the spirit of lifelong learning drive the evaluation of DIME^{PM} in an industry setting.

Kerres (1995) identifies three levels of instructional design. These are at the micro-level i.e. the design of media components, the meso-level i.e. the choice and formulation of instructional design, and the macro-level i.e. the integration of CAL in the social context of learning. The latter, he states, focuses in part on the implementation of CAL in organisations. Reaction to CAL should not be viewed as "organisational constraints", he argues, but as "design issues" at a macro level. Similarly, Tergan (1998) describes a two-stage approach to the evaluation of CAL. The first "level" focuses on the software itself and the second examines the quality of an educational program in the context of its development and its use. Accordingly, the evaluation outlined in this chapter reviews DIME^{PM} from an organisational perspective taking into account the interactions between the learner, the subject matter, the instructional method and the technology. A case study methodology is utilised in order to gauge the reaction of practitioners to DIME^{PM} and thereby identify potential facilitators and barriers to CAL. As such the approach is appropriate for a project of an exploratory nature (Williams and Falconer, 1998), aimed at offering an insight into the experiences of a group of work-place learners using new technology for postgraduate study.

10.2 Rationale

Payne (1993) highlights the problems associated with the introduction of formal project management into a traditional, functionally structured organisation. He states that the ideal technique is to start by creating awareness with educative strategies, and then move to facilitative strategies to effect change. Likewise, Loo (1995) recommends an approach that eases employees into a project management philosophy. Formal training in project management should be provided in "at least in the basics of project planning and controlling" for all employees (Loo, 1995).

The company in this case study, an engineering and project management consultancy, appears in the "Top 250 UK Consultants" (Building, 2000) and the "Top Firms in Building" (NCE, 2000) i.e. national league tables based upon the number of chartered staff and the fees rendered respectively. Directors had reviewed the company's existing organisational structures and put forward proposals that would change the current traditional functional departmental design to a matrix-orientated structure in which project teams assumed responsibility for all aspects of the commission they received. To effect such change the company's business strategy prioritised the need for training specifically targeted towards interdisciplinary working and project management. Following a company-wide review of staff performance and training and development needs, the company expressed an interest in the development of innovative training programmes tailored to the needs of their employees. Outcomes, stated in the project management module specification, appeared to be consistent with the company's requirements, drawing together the strategic aims and training needs of the organisation (refer to Figure 10.1).

The need to accelerate the learning process in construction-related companies is highlighted by Kululanga *et al* (1997) who believe that education is a pre-requisite for continuous improvement. Not that continuous improvement should focus solely on the knowledge and skills possessed by individuals within the company but that it should also address a company's ability to learn. It is submitted, therefore, that industry-based evaluations of CAL should adopt an individual and organisational perspective. As such, the research relies heavily upon the willingness of employees at all levels within the company to participate openly in the evaluation.

Bichard (2001), permanent secretary at the DfEE, recognises this imperative and urges employers to collaborate with HEIs so that educational outcomes match the requirements of industry.

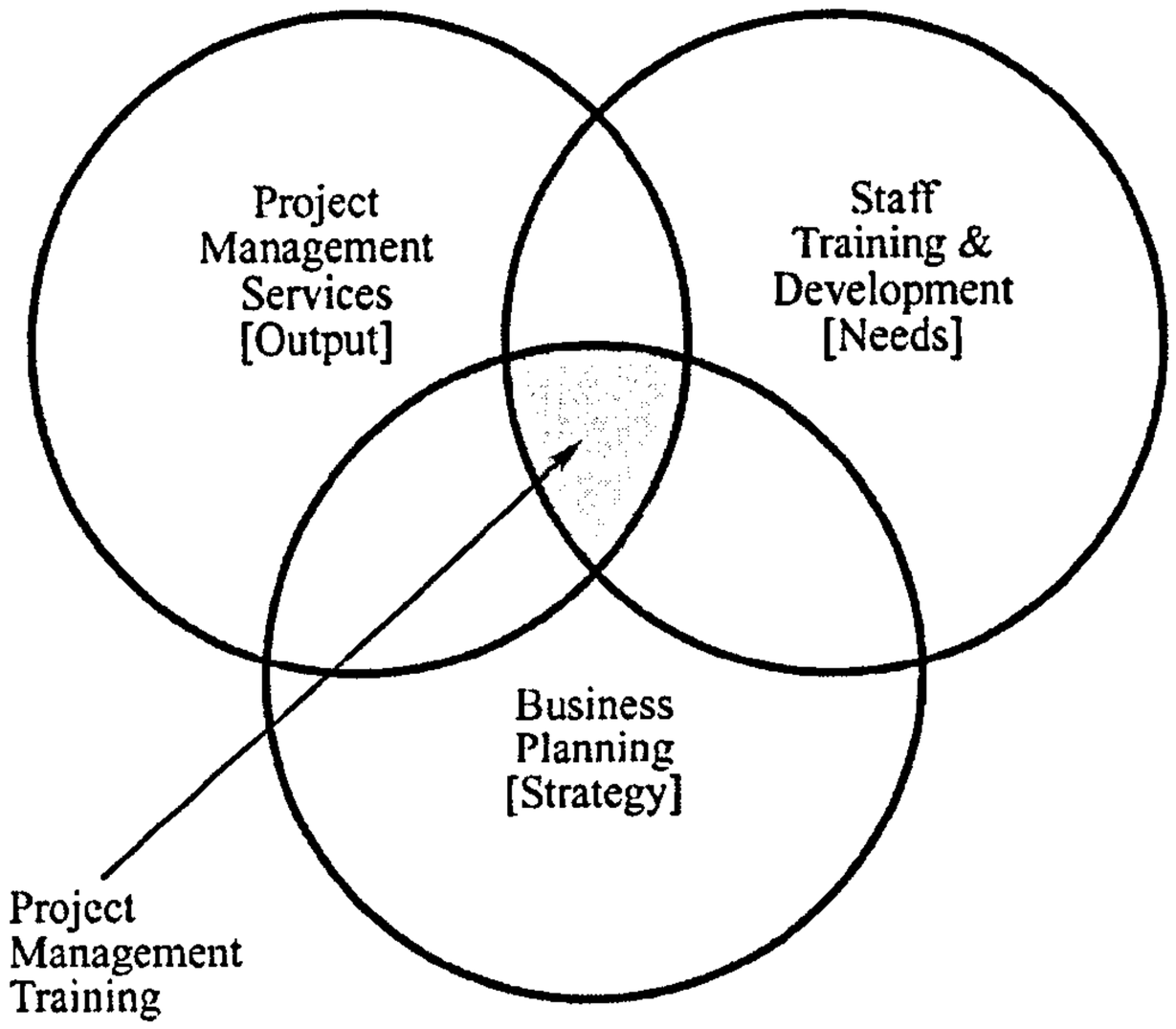

Figure 10.1 Rationale for project management training initiative

The company sponsoring this pilot evaluation of DIME^{PM} wished to remain anonymous. Their interest in the research stemmed from a desire to establish the relative worth of alternative educational programmes and to identify organisational issues that might affect the introduction of technology-based programmes.

10.3 Organisational characteristics

The company is a multidisciplinary engineering and project management consultancy established over 40 years ago. It provides a wide choice of services to a diverse range of clients (Figure 10.2) in both the public and private sectors i.e. industry, commerce, central and local government, the financial institutions, private development, the primary service utilities, transport and the retail market.

The company in 1999/2000 employed 985 staff, operating from 21 offices throughout the United Kingdom and overseas. The principal operating company is the consulting business and their largest operating unit is based in Yorkshire.

However, each office provides a comprehensive multidisciplinary service including specialist expertise in fields such as project management, civil engineering, railway management, marine engineering and contract administration. The former harnesses risk management, value management and life cycle cost analysis techniques in the effective management of projects.

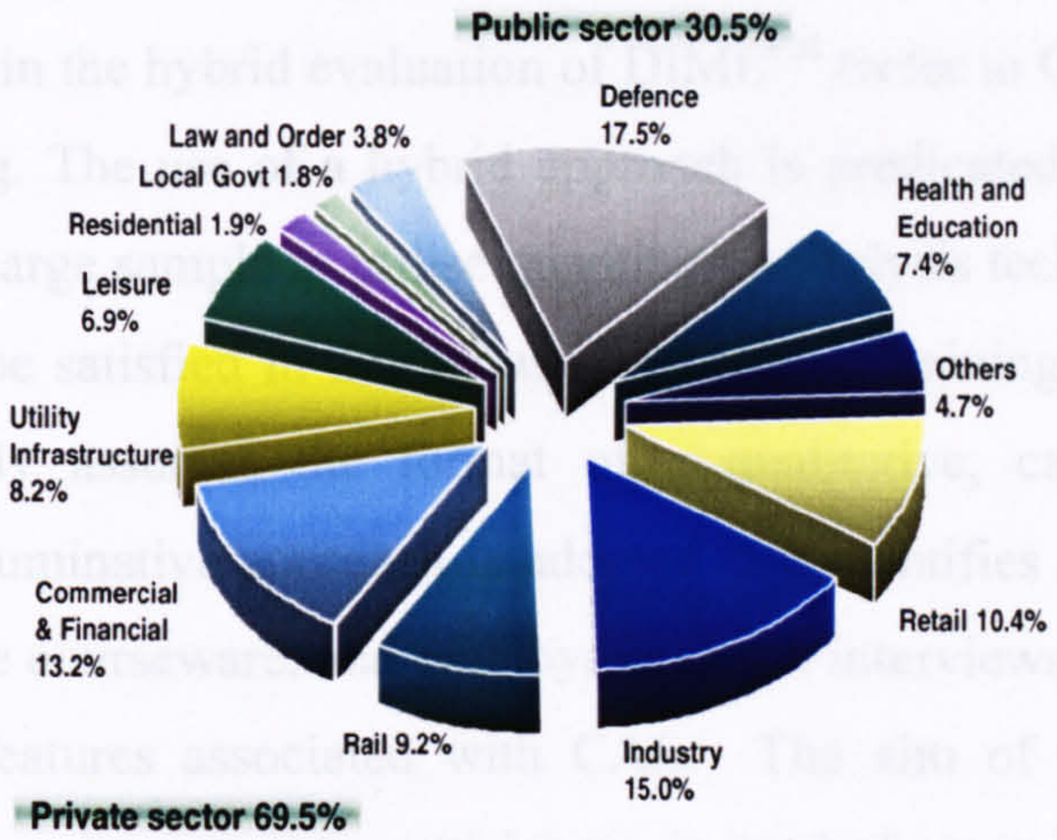

Figure 10.2 Client diversity 1999/2000 (Source: Company Business Profile)

Long term formal client relationships, in the form of partnerships, term commissions and framework agreements accounted for 35% of the company's turnover (1999/2000). Annual turnover was £45.9 million in 1999/2000. Turnover by discipline is shown in Figure 10.3.

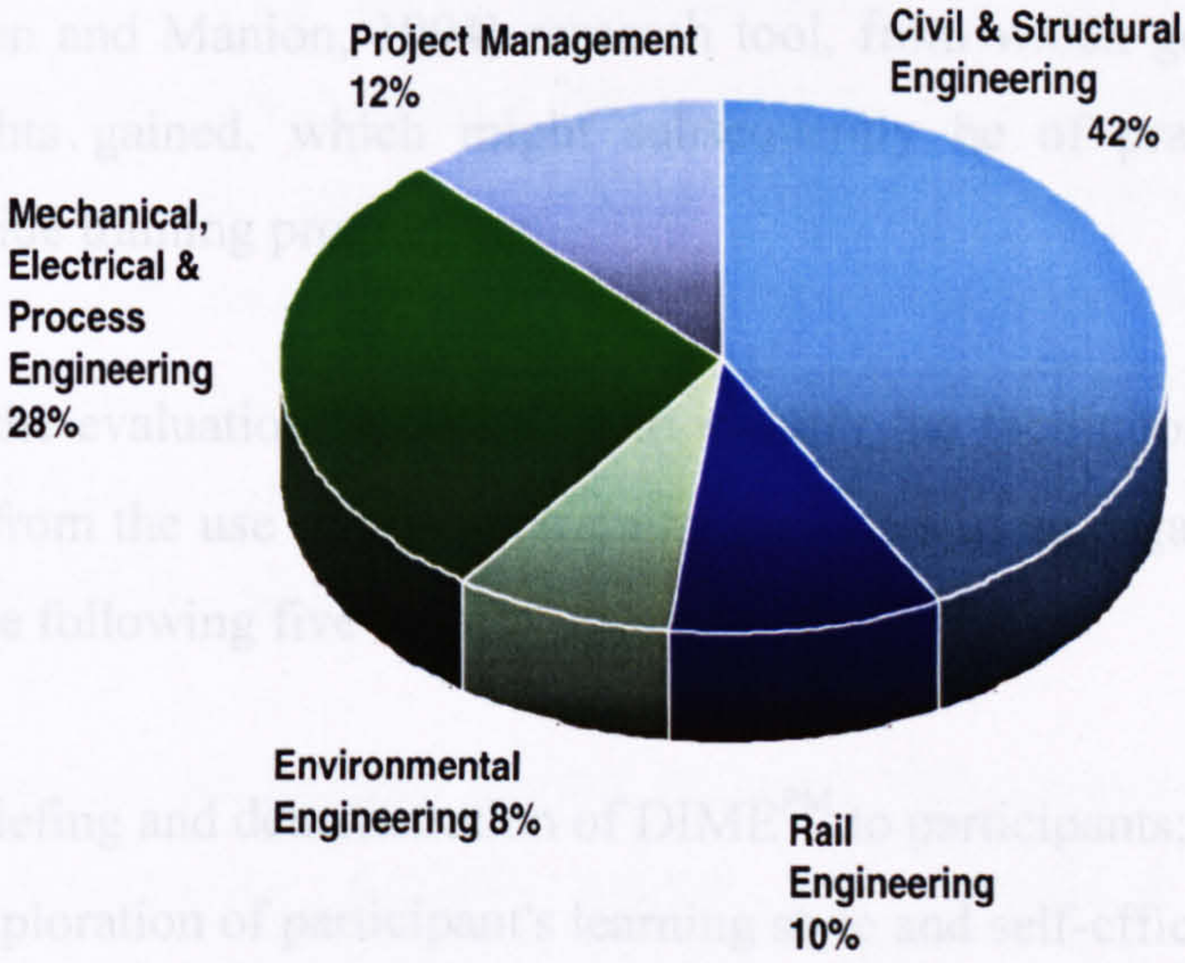

Figure 10.3 Turnover by discipline 1999/2000 (Source: Company Business Profile)

10.4 Methodology

Cohen and Manion (1994) posit that alternatives to the experimental paradigm, which they describe as "interpretative and subjective", should be viewed as complementary rather than being in competition with the experimental stance. However, the mix of quasi-experimental and qualitative approaches advocated by Corner (1991) and subsequently employed in the hybrid evaluation of DIME^{PM} (refer to Chapter 9) is not replicated in this setting. The use of a hybrid approach is predicated on there being available a sufficiently large sample to utilise quantitative analysis techniques. As this requirement could not be satisfied in this industry-sponsored training evaluation, the methodology necessarily assumes the format of a qualitative, case study-based research design. An illuminative approach is adopted that identifies all stakeholders i.e. those affected by the courseware, and employs in-depth interviews to "illuminate" problems, issues and features associated with CAL. The aim of the study is to discover the issues that are important to participants, instead of assessing how well an educational intervention performs using standard measures of assessment (Oliver, 1997).

Yin (1993) defines a case study method as an empirical enquiry that investigates a contemporary phenomenon within a real-life context. Not that it need necessarily exclude numerical data but that the inclusion of context therefore makes it difficult, "if not irrelevant", to undertake statistical analysis. The case study provides a "strong in reality" (Cohen and Manion, 1994) research tool, from which generalisations are made and insights gained, which might subsequently be of practical use in an organisational-wide training programme.

The purpose of the evaluation, re-stated, is to identify the facilitators and barriers to learning arising from the use of new IT training packages in an organisational setting and comprises the following five stages:

- Individual briefing and demonstration of DIME^{PM} to participants;
- Structured exploration of participant's learning style and self-efficacy;
- Taped interviews with participants;

- Analysis of transcripts using QSR NVivo qualitative research software; and
- Taped interview with the Director of Management Services and a Main Board Director of the company.

Interviews with participants were loosely based on the criteria in Table 10.1.

Technology:	Standards of modern instructional technology; the appropriateness of hardware and software for supporting interaction in learning.
Learner:	Constraining conditions of the individual study context (study location, time and budget); computer literacy; motivation; previous learning and education experiences.
Subject-matter:	Factual correctness and structure of the material
Instructional method:	Design in terms of instructional methods and media used to meet the requirements of the learner.

Table 10.1 "Comprehensive approach" to educational software evaluation (adapted from Tergan, 1998)

10.5 Sample

In order to gain both an informed and representative view of the organisation, the sample was drawn from each tier of the Management Services Division (refer to Figure 10.4). For historical reasons a major project for a government client fell outside the established organisational structure, therefore a representative working in a satellite office was also included in the evaluation. The six participants taking part in the evaluation was at Associate Director (Grade 3), Associate (Grade 4), Senior Project Manager (Grade 4), Project Manager (Grade 6) and Associate Project Manager (Grade 6 and 7). All participants were volunteers:

Associate Director: an experienced project manager with extensive experience of multi-discipline construction projects gained with consulting engineers and contractors on a wide range of major projects in defence, industrial, leisure and marine sectors of the construction industry.

Designation	Grade
Main Board Director	1
Director of Management Services	2
Associate Director	3
Associate	4
Senior Project Manager	4
Project Manager	5
Assistant Project Manager (Engineer)	6
Assistant Project Manager (Assistant Engineer)	7
Administration	5/6

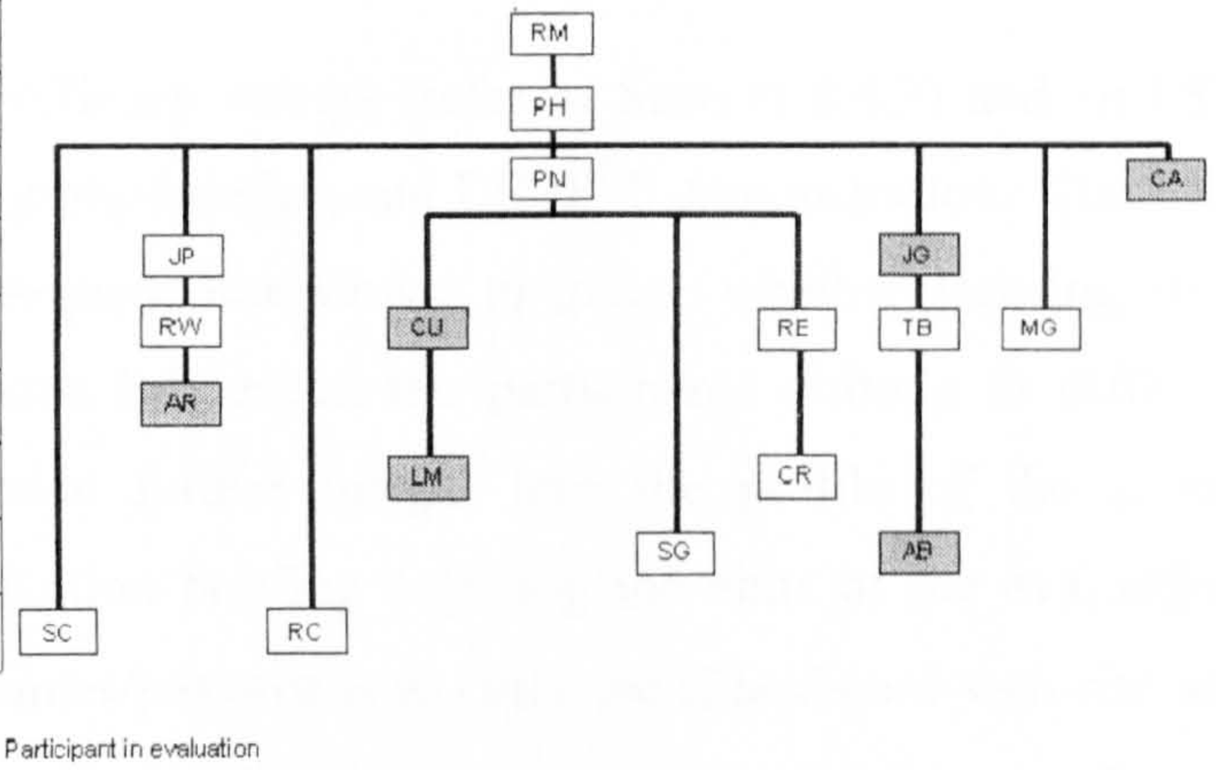

Figure 10.4 Divisional structure within Management Services (Source: Company Business Profile)

Associate: an experienced project manager with 20 years experience gained in the industrial, commercial and nuclear sectors of the construction industry. Specific project management skills include the co-ordination of projects involving specialist services and complex M&E work.

Senior Project Manager: an experienced project manager with over 25 years experience in the design, supervision and project management of building and civil engineering projects with particular reference to the defence industry.

Project Manager: a project manager who has worked both in a support function and as a project manager on individual projects. Particular skills include design team planning, resourcing, time and cost programming.

Assistant Project Manager (Engineer): a Chartered Engineer with six years experience in flood defence assessment, canal restoration and project planning and programming.

Assistant Project Manager (Assistant Engineer): a recent project management graduate currently providing a support function on defence work projects.

10.6 Procedure

All participants completed self-efficacy ratings (refer to Section 8.4.3) and an LSQ (refer to Appendix F) prior to a group briefing and DIME^{PM} demonstration. The LSQ provided a prompt during subsequent interviews, to gauge whether learning style preference was perceived to have influenced the participants attitude to different learning activities and to provide further insight into the profile of the group. Participants received a pre-evaluation briefing outlining the aims of the evaluation. They were provided with usernames/passwords to enter the Blackboard web-site and encouraged to use synchronous and asynchronous communications to create a "group list" of technical issues associated with the operation of DIME^{PM}.

Each participant was allocated 15 hours in-company staff development time to review the content and operation of DIME^{PM}. Commercial constraints restricted further study although participants were offered the opportunity to complete, in their own time, an Advanced Professional Diploma in Project Management at Leeds Metropolitan University. The operational plan (i.e. Ellis-Cross Estate) and video presentation assignments in DIME^{PM} provide credit towards the postgraduate award. A task-based approach was adopted and participants were requested to develop discussion threads and use the synchronous communication facilities on the Blackboard web-site prior to the interview.

Interviews were held with each participant on completion of the evaluation period. Interviewees were assured of confidentiality. As agreed with senior managers in the company the maximum duration of each interview was one hour. All interviews were held at the company's head office. Transcripts of each interview were reviewed for accuracy before being loaded into QSR Nud*ist Vivo 1.1 (NVivo) qualitative research software (refer to Appendix J). Richards (1999) argues that qualitative projects need "containers for ideas, and links between those ideas and particular data". Accordingly, analysis applied the concept of "creative coding" (Richards, 1999), coding units of meaning (Miles and Huberman, 1994) as free nodes before categorising the data in tree nodes (akin to network analysis, described in Section 9.6). Richards (1999) describes this process as "thinking up" the data to create greater generality.

In order not to divorce meaning from its context, codes were applied to passages of various length i.e. parts of sentences, sentences and paragraphs (refer to Figure 10.5).

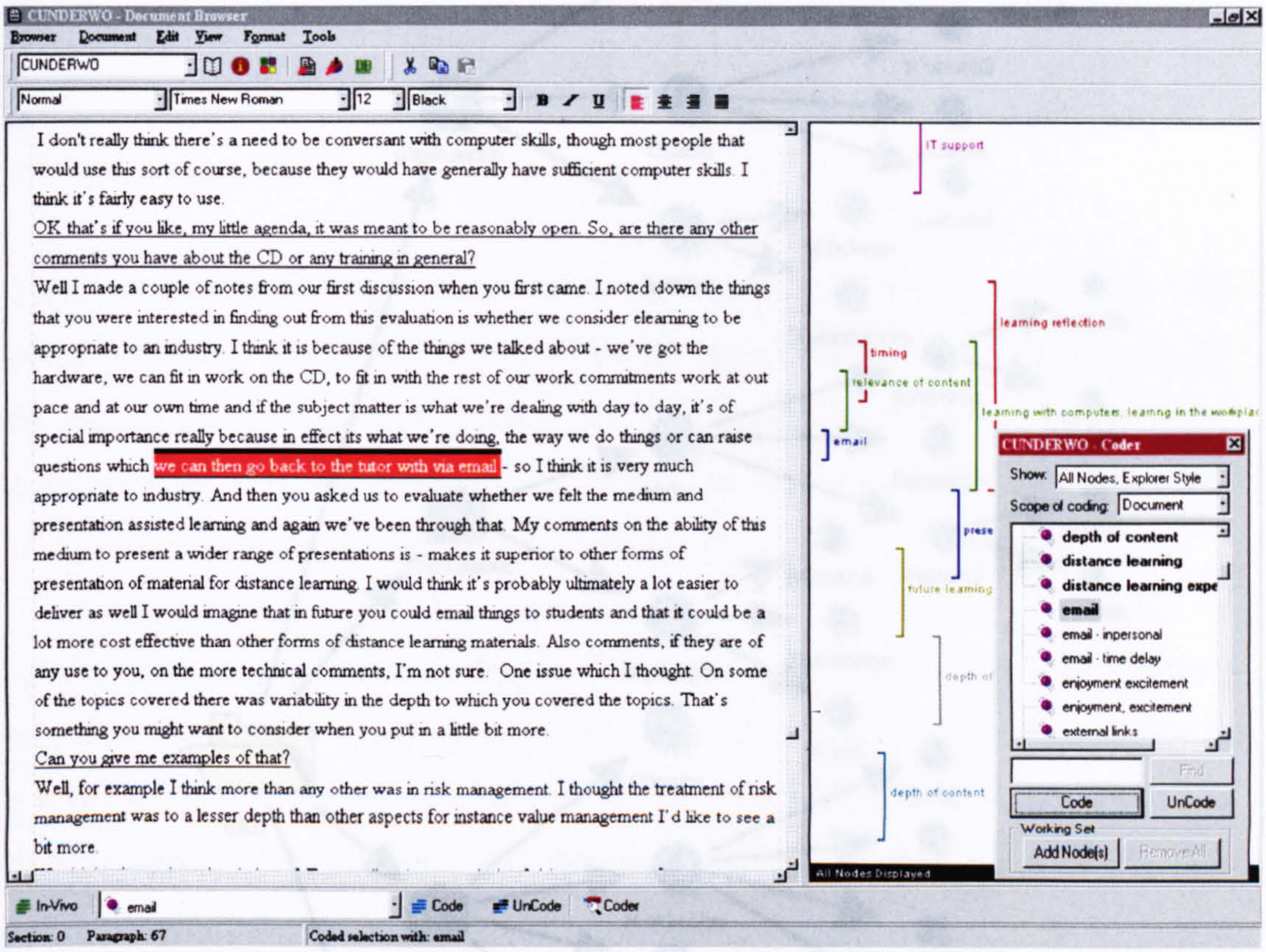

Figure 10.5 Coding interviews in NVivo data management software.

A provisional start-list of codes was based on the criteria set out in Section 10.4 and the questions developed subsequently for the semi-structured interviews (a method preferred by Miles and Huberman (1994)). However, the number of codes increased dramatically upon closer examination of the data. As new codes were generated so a reassessment of earlier documents was required. This iterative process continued throughout the initial "coding stage" and as the data was combed for further meaning, further refinements to the codes became necessary. The evolving structure comprises "larger" (more conceptually inclusive) and "smaller" (more differentiated) codes (Miles and Huberman, 1994) and is displayed in hierarchical form using NVivo software (refer to Figure 10.6).

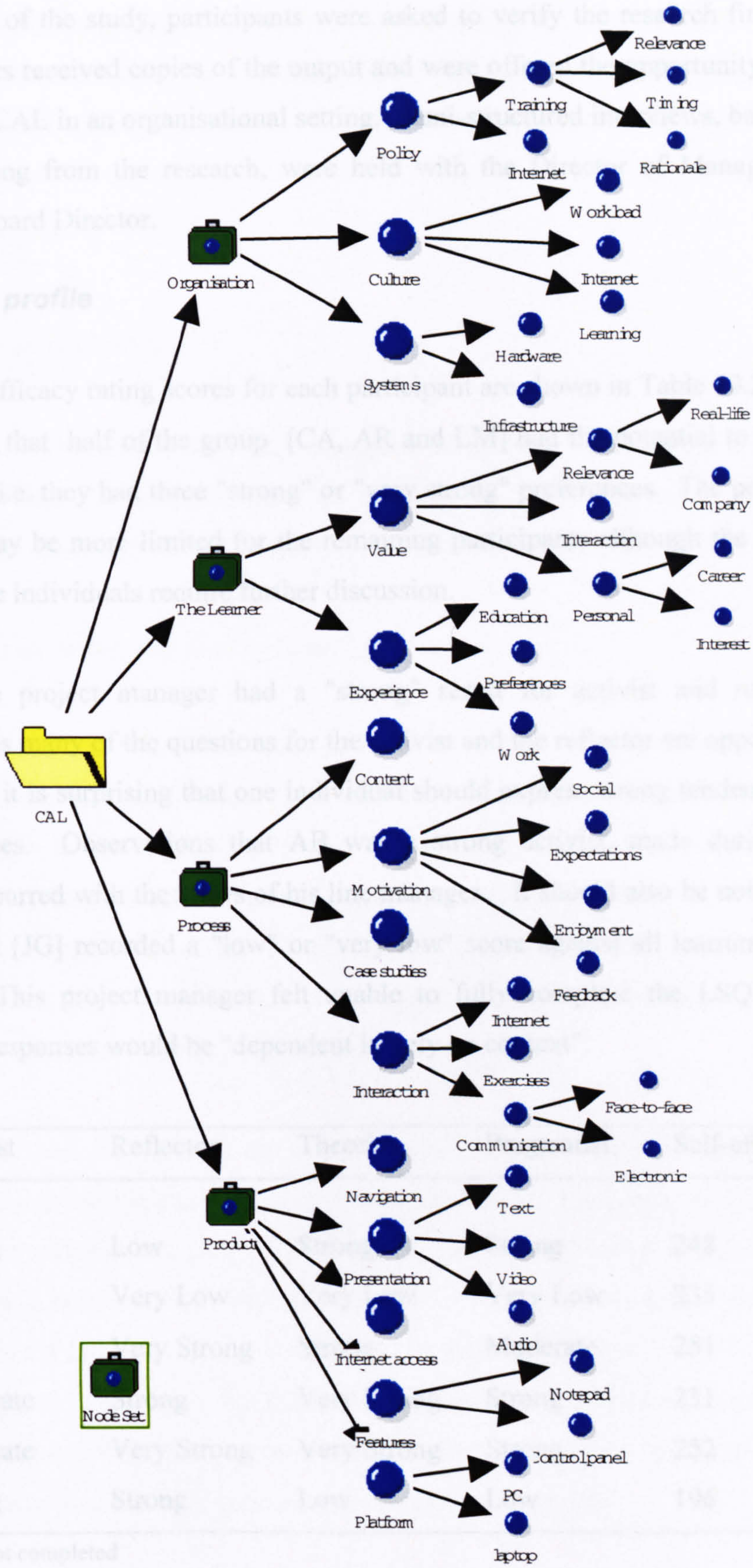

Figure 10.6 Hierarchical organisation of nodes (produced in QSR NVivo 1.1)

On completion of the study, participants were asked to verify the research findings. Senior managers received copies of the output and were offered the opportunity to air their views on CAL in an organisational setting. Semi-structured interviews, based on the issues arising from the research, were held with the Director of Management Services and Board Director.

10.7 Group profile

LSQ and self-efficacy rating scores for each participant are shown in Table 10.2. The former suggest that half of the group [CA, AR and LM] had the potential to be all-round learners i.e. they had three "strong" or "very strong" preferences. The potential for learning may be more limited for the remaining participants although the results for two of these individuals require further discussion.

Unusually one project manager had a "strong" result for activist and reflector preferences. As many of the questions for the activist and the reflector are opposite in their meaning, it is surprising that one individual should express strong tendencies to both preferences. Observations that AB was a strong activist, made during the interview, concurred with the views of his line manager. It should also be noted that one participant [JG] recorded a "low" or "very low" score against all learning style preferences. This project manager felt unable to fully complete the LSQ as he perceived his responses would be "dependent largely on context".

	Activist	Reflector	Theorist	Pragmatist	Self-efficacy
CA	Strong	Low	Strong	Strong	248
JG*	Low	Very Low	Very Low	Very Low	235
CU	Low	Very Strong	Strong	Moderate	251
AR	Moderate	Strong	Very Strong	Strong	231
LM	Moderate	Very Strong	Very Strong	Strong	252
AB	Strong	Strong	Low	Low	196

* 16 statements not completed

Table 10.2 Learning Style Questionnaire results

Self-confidence in being able to perform tasks set out in the 34 item self-efficacy scale exceeded 75% (i.e. 230) for five participants. AB was the least confident in the group. This result appears consistent with the experience and designation of the project manager.

10.8 Analysis

10.8.1 Organisational context

DIME^{PM} provided "the basics of project management" [JG]. It was relevant to project management within the company and all participants were conversant with the material with the exception of the "Project" Unit case study particulars.

> *It's got everything you need to know.* [AB]

Company hardware was "more than capable" [AB] of running the CD-ROM although it became apparent that participants' PCs had been upgraded with soundcards and headphones prior to the evaluation [AR]. As expected there were some minor functionality problems associated with running the system on Windows NT [JG], DIME^{PM} having been packaged for Windows 95/98. These were considered not to have affected the overall performance of the application as the technical problems which did arise could not be directly attributed to the Intranet.

All participants used the Internet on a day to day basis for research, accessing a variety of technical and professional information e.g. British Standards, design codes and government publications [JG]. The Internet was an established tool, available both for work and personal use, although individual access was necessarily limited to specific times in the day to avoid system failure. At times this proved restricting [AR] but there was general agreement that organisational policy i.e. restricting personal use to lunch-time and evenings, was appropriate and there appeared to be no hardware-related problems associated with access to the Blackboard web-site.

All workstations in the satellite office were able to download applets from the web i.e. QuickTime. The advantages of such a policy were perceived to outweigh the potential problems associated with limited server space and computer viruses [CA]. It was less clear whether participants at the company's head office had similar administration rights. Some participants claimed these facilities were not available without recourse to IT support staff [AR, JG, LM]. One participant, however, had downloaded the software directly onto the server [AB]. Despite this confusion, all participants felt that IT support was largely unnecessary for operating the CD-ROM.

Workplace learning presented many problems for participants. In part this was attributed to commercial pressures.

> *The culture within [the company] has changed and we are now more of a commercial business and even people down to assistant project management level are very aware that we are a commercial organisation that has to make money to keep our own job if you like. So this is something that is drummed home time and time again.* [AR]

Work, therefore took priority over learning. The opportunity to set aside time, while theoretically possible [LM], seldom occurred due to fluctuations in workload [AR]. A very heavy workload, long hours [CU] and an environment characterised by constant "interruptions" [CU], "people coming to see you" [JG], meetings and phone calls [AR] made it "difficult to break off to study" [JG].

> *If you've got a full in-tray and you're sat at your desk using your computer ... it's hard to really justify it, to do something different.* [LM]

As a consequence some participants undertook the evaluation at home, preferring not to stay late at work [LM, AR] while others used the CD-ROM in the workplace outside the normal working day [CU, JG, AB]. On occasion this was influenced by the specification of the participant's home PC [CU] or personal circumstances [AR, CU]. The office manager was alone in conducting the evaluation principally during the day [CA].

I've actually got the luxury of running the office down there so no one's going to come in and say 'what are you doing'. But arguably it's the kind of system that allows you half an hour and you can dip in and dip out without any great problems. For instance, I found I could come away from meetings and the last thing I actually want to do is sit down and start thinking about minutes and it's quite nice to come back and dive off and do a little bit of time on that [DIME^{PM}]. [CA]

Indeed all participants acknowledged the inherent flexibility that CAL offered in allowing study "at our own pace, at our own time" [CU]. Arguably, this facet of CAL was a weakness in the workplace. As it was possible to "fit in work on the CD with the rest of our work" [CU] there was little to prevent work commitments from being given higher priority than learning.

> *... unless you're extremely well disciplined and you say 'right, no nothing between three and five is going to get in my way of this task' in terms of training, then I think it's very difficult to concentrate when you are in the building.* [AR]

Some participants [AR, JG, LM] suggested that an organisational policy would be required for say a graduate training programme "giving half a day a week to sit down and do something". [JG] It was important that specific periods of time were time-tabled into the working day not only to aid study but also to alleviate feelings of "guilt" [LM].

> *The ideal situation would be if your line manager says 'I know you need two hours, so that Friday morning, the first two hours, you'll be doing that wont you?' and so it's known that no one will be feeling guilty about this. You wouldn't feel you were pushing something else out of the way to do it.* [LM]

This in itself would not satisfy all participants, as training located physically in the company, with work colleagues, was viewed to be limiting.

> *If you're learning here [in the company] the chances are you'll be learning with people you already know and you see these people anyway ... and you're not widening your experience, widening your knowledge base.* [AB]

The reasons for pursuing postgraduate education and vocational training programmes were varied and arose as a result of company pressure and/or individual motivation.

The former, was in part seen to be a response to clients' reluctance to accept experience in lieu of professional qualifications [AR]. Membership of the APM was not in general recognised as being of sufficient standing, therefore managers were insistent that their staff should gain Chartered Engineer (C.Eng) or Chartered Builder (MCIOB) status [AR]. Investment in training, from an organisational viewpoint, had a two-fold benefit. "While the whole point of training is pay-back" [CA] it was recognised that it might also have an impact on staff retention. Previous experiences suggested, however, that the company only supported training that was directly relevant to the work undertaken on a day-to-day basis [AR].

The latter, was either career-driven [LM], to keep updated [CU, JH] or for personal interest and satisfaction. Postgraduate qualifications, in general, were perceived to have become commonplace and were arguably a necessity for professional consultants in this field [CU].

10.8.2 The learner

The desire for "real-life" education, relevant to the workplace, was a recurring theme. How this might be integrated into an educational programme was, perhaps, best embodied in the following quote:

> *I think I categorise project management as a more chaotic structure, which is what real life is. So project management comprises all these things [DIME^{PM} Units] and the way you arbitrarily provide a boundary between each of the subject matters is very much whether that is important to somebody to understand it. How then it is mixed in the cookery book of real world afterwards is very much the next stage of understanding, isn't it? And to a certain extent the case studies help with that although they obviously have to be a bit more simplistic than they actually occurred. But what real life is about is understanding the blurred grey areas around all the things that you teach and the people then have to apply experience to be able to understand that.* [JG]

The value of authentic project scenarios and case studies was acknowledged by other participants [AB, CA]. Furthermore, the use of video clips in the assessment brief provided context and emphasised "the perspective of real clients" [CA]. All attempts to link theory with practice were well received as "it's helpful to put into practice some of the things discussed in part of the module" [CU]. DIME^{PM}'s relevance was therefore perceived to be a strength.

> *... if the subject matter is what we're dealing with day to day, it's of special importance* [CU]

Both the softer issues e.g. communications [CU], and project management tools and techniques e.g. risk management [AR, CA], were aligned with the company's training needs.

> *A lot of what I saw there was relevant certainly to the kind of business that we're in and certainly working on the projects where issues such as value engineering and life cycle cost analysis are particularly important.* [CA]

There was however a place for both direct technical job-related training to do specific tasks and a place for broader training. While gaining a breadth of knowledge was worth doing from an individual's point of view [AR, CU, JG, LM] it could also be to the company's benefit as it looked to expand its client base and enter new markets.

> *It [training] may not be directly relevant but there will be bits and pieces you can pick out ... to develop and push forward within the company.* [AR]

It was surmised that such views might conflict with senior management's training objectives [CU].

The group was split regarding which mode of distance learning they preferred i.e. CAL [AB, AR, CA, CU] or its text based equivalent [JG, LM]. But the apparent dichotomy between CAL and correspondence style distance learning was perceived to be an artificial distinction, as indeed was the distinction between traditional face-to-face and distance learning.

> *I think its [DIME^{PM}] great, it's fantastic when it's backed up with the equivalent amount of, "real" if you like, face-to-face discussion groups.* [AB]

A combination of face-to-face delivery of the "core material" and exercises on disk, it was suggested, would provide an "incredibly useful way to actually present the information" [AR]. In a distance learning context a mixture of text and other media could also be beneficial as one participant observed who had had prior experience of distance learning delivery [JG].

Indeed the preferred mode of learning was seemingly affected by previous learning experiences and the participant's own learning style. For example:

> *... everyone's into computers these days. Everyone likes the little twiddly bits don't they? That's the appeal, especially to the younger end.* [AB]

One participant, who had recently studied an APMP accredited course at LMU and was consequently familiar with the course material, had little difficulty navigating through the CD-ROM [AR]. It is posited that such prior learning might have aided understanding and assisted in the operation of the CD-ROM. Another participant, whose past experiences on traditionally delivered training courses had been somewhat mixed, was again supportive of novel forms of distance learning delivery [CA].

> *I've found quite a number of ... professional training courses quite inefficient ... and this idea that you have to go along to a training course and you get coffee on your arrival, coffee and biscuits at 10 o'clock and have a nice lunch which actually puts you to sleep in the afternoon. By the time you get to questions the lecturer has bored you rigid.* [CA]

> *I likened it [DIME^{PM}] to Encarta or Britannica ... once you understand the principles of how you move from one point to the next it's arguably a simpler way of working.* [CA]

Conversely one participant, who had never taken any form of distance learning and was unfamiliar with CAL, found the whole experience refreshing and was keen to adopt new approaches to learning [CU]. Not surprisingly, all participants who preferred the CD-ROM to a book suggested that CAL would become accepted practice i.e. it represented "the way forward" [AR]. The web was perceived to be "changing our lives dramatically" [CU] and as graduates came increasingly into contact with CD-ROMs, CAL for postgraduate education and industry training would become commonplace [AR].

Others preferred books [JG, LM]. They reasoned:

> *You can flick through a book without problems and you can do it quickly. You can skim read a book quickly. It's more difficult on a CD-ROM because you have to flick through screens. You can multi-reference much more quickly so you can keep your thumb or fingers in various pages and just flick backwards and forwards.* [JG]

> *Because it's [a book] down on the flat level surface. When I'm trying to learn I take notes ... and if you have your notes and your book on the same table, your eyes are just running across. The screen to notes does distract you a bit more.* [LM]

Both responses suggest weaknesses in the navigation and note taking features in DIME^{PM}. Comments such as these reinforce the importance of the instructional design and multimedia development stages in the production of a CAL application i.e. the process and the product.

10.8.3 Process

> *You learn by taking in all the senses and if you do it by distance learning you are only using some of them.* [JG]

Arguably, multimedia technology provides the opportunity to satisfy these senses and it had for participants raised their expectations regarding the quality of the media content. Users expected "to see more and learn more from an image" [CA]. Graphics lent excitement to the learning experience and if, at times, they were of a lesser quality, there was a sense of disappointment and having "not learnt quite so much". Similarly video and audio clips were regarded as being helpful. They maintained interest and made the learning experience overall a more enjoyable one [AR]. CAL had to provide more than a textbook if it was to "grab the user's attention and keep them going through it" [CA].

> *I liked the idea of video clips. It makes things a bit more three dimensional especially with the Internet sites. Brought it to life. You need a bit of that ... yeah, I think you need it, definitely.* [AB]

Clearly, it was the web-capability and interactivity of the program that distinguished DIME^{PM} from a book. And it was these features, and the way that they were integrated into the package, which provided the necessary motivation to work through the CD-ROM [AR].

> *I think the advantage that a CD-ROM does have over a book is where you have external links ... you could pull off references or examples and interactive things ... I used the search engine on the DTI web-site which was easier to use than just hacking into and browsing the system.* [JG]

The majority of participants [AB, AR, CU, JG, LM] found the structure of the CD-ROM easy to follow. Comments such as "It provided a very good framework, a skeleton of what's needed" [JG] and "...very easy to understand" [AB] were typical. Conversely one participant [CA] expressed surprise that the Topics listed should have been classified as they were. No examples were given. It was suggested that four Units was too few and that this had resulted in a "tremendous amount of information" being placed under each of them. Increasing the number of Units to "say 6 or 8" would have reduced these problems [CA].

> *I think someone who knew something about project management, not a great deal, might get lost in what happens when you drill down under those [Units]. Therefore I think there should be some kind of structured mechanism to it.* [CA]

The ability to track progress using the Recent button was helpful [AB] but this, it was suggested, could have been improved by highlighting previously visited learning points on the content menus [LM].

Lack of consistency in the number of pages in each Topic was also a hindrance [JG] aggravated by the presence of a limited number of headings [CA]. Suggestions for improving navigation focused on control panel operability and the GUI (refer to Section 10.8.4). The concept of a "Tab" metaphor, similar to that used in Microsoft applications, was recommended [JG]. Clearly, the conventions used in popular user applications affected the participants' expectations and requirements.

Arguably, the Digital Notepad, had the greatest impact upon the users' approach to learning. Reaction to this feature was mixed:

> *The opportunity of actually putting text notes in yourself is wonderful. You can't start writing all over a text book in that way.* [CA]

> *I was one who never wrote in books so the fact that you can print it off, write down the side and make your own notes, I think, is extremely helpful for people who fall in the half way house.* [AR]

> *I find it really annoying. You're writing your notes and then you click to the next page and you think I'll write a note on that as well and then you've got to open the notebook again.* [LM]

Had the Digital Notepad remained open between screens then the user would have been able to "cross reference and spin around" [LM]. Such diverse views however tend to strengthen further the argument that CAL must cater for a variety of learner preferences, making available alternative facilities to accommodate diverse user needs. Failure to do so, disenchants learners who might otherwise benefit from this mode of learning. But the relationship between learner preference and instructional design is complex. No observable patterns were revealed between the participants' LSQ results and their reaction to DIME^{PM}.

There was little disagreement with the factual content of the material on the CD-ROM but some Topics, it was felt, had received variable treatment in terms of depth [JG]. Yet there is little consistency amongst participants regarding the Topics that had and had not been treated shallowly. One participant excused the apparent failing of DIME^{PM} in this respect:

> *But you have to start somewhere and I think the level that this particular exercise [DIME^{PM}] is pitched at is appropriate for graduates.* [JG]

References to relevant chapters of key texts were construed as being helpful [AR, JG] although the number of sources varied from Topic to Topic [JG]. It was suggested that this facility could be improved further by linking directly to an on-line library catalogue.

> *There's nothing worse than sitting down to do some studying and finding that you have to go over to the library and get bits and pieces. It was pretty much all there.* [CA]

Availability could then be checked and books reserved [AR]. References might also include industry opinion rather than mere textbook analysis [CA]. Concern was expressed, however, that the comprehensive treatment devoted to some subjects eliminated the need to undertake further research [AB].

Expressions of enjoyment, excitement and interest occurred most frequently when participants made reference to the use of alternative media, interactive exercises and case studies.

> *... the exercises, I thought, were an incredibly helpful way to actually present the information ... I really enjoyed the exercises, the sound bits, the video bits, the interactive bits. That kept my interest.* [AR]

Moreover the presence of immediate feedback enhanced the learning. One participant referred to "playing around with interactive displays" so as to modify personal profiles based on Belbin's work [JG].

> *Yes, it's interactive. Certain elements were marvellous... where you asked if you were to win a lottery ticket and what was the minimum amount that you would accept for it. Okay, that was a very good exercise because you had to think the answer through. But it was interactive. It responded to the answers you were giving so it was a lot more than a text book.* [CA]

Not all exercises incorporated the same level of interactivity and, having raised expectations on one activity (as with media and graphics) there was disappointment when other exercises did not promote the same level of understanding. There was a need for consistency, not only in presentation but also in the level, interaction and feedback offered by each activity.

Another participant compared DIME^{PM} to the MERIT2 Construction Management simulation game [LM].

> *Merit excites you to do something because something comes out each week and you've got feedback every week and that works because there's a regular jab in the back and they're expecting information from you ... so that works.* [LM]

Feedback should not only provide a suitable "kick" [LM], prompting users to work steadily through the resource, it should also encourage the exchange of ideas [CA] "at the time you are trying to understand the issues" [JG]. For one participant, distance learning, in whatever form, seemed unable to offer this vital component in the learning process [JG].

> *If you are reading text you can read through it and you can think you've understood it. The only way you will know you've understood it is when someone questions you on it. Therefore the points of learning that you might get out of it on first reading are what you assume them to be.* [JG]

It was suggested that formative questions at the end of each Topic [JG], comprehensive feedback following each interactive exercise [AR], the articulation of "some kind of structured approach" [CA] and the opportunity to discuss issues with tutors and peers [AB] might overcome some of these problems. In essence a form of Open Distance Learning.

> *Distance learning allows you to reflect after the event but not to ask the questions as easily. The disadvantage is that when you're going through distance learning and doing it by yourself ... at the time there is only you to adjudicate whether or not the points that you are picking up are the points that you will be expected to understand from the information presented.* [JG]

The use of electronic communication to overcome some of these difficulties received little support. Participants were not comfortable with sharing ideas in this way [CA].

> *...I find emails very impersonal and don't particularly like them. People tend to think of them as an easy method of conversation. But it's not because there's a time delay on it and you cannot chat with a time delay. It's like trying to introduce a 10 second delay in a transatlantic telephone conversation.* [JG]

Participants knew the facilities existed. Indeed they had been prompted to create a lively web-site, but it was perceived to be "just that step further forward that we haven't taken yet" [CA]. As such it seemed to mirror the attempts made by the company to develop collaborative working environments. The concept of setting up project specific web-sites on a company server to promote the sharing of information had been "talked about for a long time" [CA] but had not been actively pursued.

> *I'm a great believer in changing the way we work. Two days out of five we could work at home and I'm on a construction site.* [CA]

It was argued that this apparent reluctance to use alternative communication was a cultural phenomenon that could only be overcome when staff necessarily had to rely on the technology. The fact that distance learning was, for some, the only study option [CU] may also provide the catalyst for a change in behaviour.

Consequently email communication was viewed as a last resort, when face-to-face discussions were not possible.

> *If you're sat around a table discussing something, you can see what's happening, you can see who's talking, who's thinking, who's not talking. When you only have voice or text obviously you can't see that and it prevents the full communication process.* [JG]

In theory eCommunication was “limitless" [AB] but it was "convenience 'electronic world'" [AB]. Contact could be made with tutors via email [CU] and students could post comments on web-sites [AB], but in practice “real life, face-to-face talk” [AB] was preferred. The need for personal face-to-face contact was a recurring theme not merely in a communication context. There was a social dimension here too, offering the scope to “branch out, meet new people, new experiences” [AB].

Distance learning relied upon the discipline and motivation of the individual [AR, LM]. Lack of social contact and a structured approach weakened students' resolve.

> *In terms of distance learning I need people to make me do things.* [LM]

Such reaction is not unexpected due to the formative nature of the evaluation. Participants had not been enrolled on an academic award and as such were not required to submit assessments in accordance with module deadlines.

10.8.4 Product

The quality of presentation received universal approval. Described as being "helpful" [AB] and "interesting" [CU] this facet of CAL was attributed to the nature of the medium. To alleviate the boredom of reading from a screen [CA] there was need to break up textual material with exercises, graphical imagery, animation and sound. As such CAL was perceived to be a medium that offered more scope than the written page [CU].

> *...this medium has the ability to present a wider range of presentations. Makes it superior to other forms of presentation of material for distance learning.* [CU]

Although spelling mistakes and grammatical errors were evident in DIME^{PM} [AR, CA] most comment was directed towards the amount of text on the screen. It was thought to be low [CU, JG], "a couple of paragraphs, obviously less than a book" [CU], and as such left the impression that there was rather less textual content than one would otherwise expect from its hard copy equivalent. As a consequence users were "flicking backwards and forwards between sections to get a feel for a total entity" [JG] which led to a request for "multiple panes" [JG].

Despite these criticisms the weight of text on the screen was adjudged to be appropriate for computer-aided delivery.

> *I felt that [the amount of text on screen] was beneficial because one of the problems I think with computer learning, as with all word processing activities, is that the eye doesn't see what's on the screen. If you are looking at a piece of paper you can see the entire page. When you look at it on a computer screen, for whatever reason, you don't get that same perspective.* [JG]

Audio, video and animation sequences ran smoothly on company hardware although problems were experienced with home PCs [CU] and in particular the sound levels on laptops [CA, LM]. The latter was attributed to the noise of the CD drive and the internal fan. It was a problem seemingly exaggerated when listening to audio clips where there was no supporting video [LM]. The small size of the video image was criticised [JG] together with the production quality of both the audio and video sequences [CA, LM].

The CD-ROM appeared to be unstable on the two laptops used during the evaluation [CA, LM]. Both booting-up and quitting the program caused problems the first time DIME^{PM} had been launched. Furthermore, navigation control facilities, such as the forward and backward buttons, which operated on a mouse click, were a source of irritation to laptop users who preferred the arrow keys to the mouse or "Accupoint" control button on the laptop.

Similar sentiments were expressed by another participant [AB], who was familiar with WordPerfect. She preferred to use computer keys to the mouse. Elsewhere the self-play facility had functioned effectively and had run DIME^{PM} "in a very stable way" [CU].

Speed was not an issue on company PCs. But on occasion DIME^{PM} menus were slow to regenerate [JG], movement from page to page was not instantaneous on one ageing home PC [CU] and as a consequence of a technical fault on a laptop [CA], the CD-ROM performance was extremely poor.

Access to the Blackboard web-site was problematic. Two participants [CU, LM] did not get beyond the entry screen due to difficulties working through the log-on procedure and one participant [AR] failed as a result of a faulty modem connection to reach the Blackboard homepage. The other half of the group "had no problem at all" [AB, CA, JG]. All participants did at some stage, however, use the Internet to open pre-defined URLs.

Downloading software was not a source of technical problems [AR] but it was a long and costly procedure when accessed from home [LM]. It was suggested that this could have been avoided had the software been packaged with the application.

10.9 A management perspective of CAL

Contrary to the approach taken by Scriven (1967), who considered that contact with the sponsor of the training would "contaminate" an evaluation, the research findings were circulated to senior managers in the company[1]. A semi-structured interview was held with the Director of Management Services and a Main Board Director. Their reactions to CAL were used to triangulate the research findings.

Senior managers considered lifelong learning to be the only way to remain successful as a company [PH]. Lifelong learning was essential and as such did not conflict with a commercial environment [RM].

[1] The observations made by participants could not be attributed to the individuals concerned.

They were pleased that participants were seemingly aware of commercial realities but felt that the motivation to pursue further studies came from the individual rather than as a result of company pressure.

> *I don't think learning is in conflict with a commercial environment. To evolve and to maintain your position ... you have to re-educate all the time. Life long learning is an essential journey you go through.* [RM]

Training as opposed to education, if a valid distinction could be made, had to be relevant [PH]. Education in some way "banked knowledge" [RM] or "amassed credit" [PH] that could be drawn on at any time, in any situation, whereas training was perceived to be associated with the application of skills to the current task in hand. Not that this, it was stressed, should imply that training must necessarily be confined to job-related tasks. Rather, it must be aligned with the commercial needs of the organisation [PH].

> *We're not just interested in the here and now. There is a rounding process and there is need for greater involvement in a wider sense so that people have an identity in the company and the community ... which allows some team building and allows people to think more laterally in how they might deal with problems.* [RM]

Education and training were also linked to staff development - the latter seeking to develop an individual's capacity "to do something in the future which you don't have an application for" [RM].

> *It's one continuum ... I feel quite strongly about lifelong learning because you are going through this iterative loop all the time moving forward.* [RM]

It was also important that the company saw a return on their investment. Internal seminars, run by in-company staff, attracted no direct costs. They could be focused on precise company needs. But they lacked fresh views [PH] and external influences [RM].

External courses, however, were seldom specific and "you might be lucky to get 10% value out of it" [PH]. The fear with distance learning was that it might go "unchecked" and there would be no way of knowing whether a member of staff had undertaken the work or not [PH].

Project management was perceived to be a "bold subject area to tackle" [RM] in distance learning mode, largely because the factors that contribute to a successful project were perceived to revolve around "leadership and the softer issues" [RM].

> *One element you miss [in distance learning] ... is the interaction with other people who are learning at the same time, which I think, is as valuable as the education.* [PH]

Indeed distance learning per sé was not the delivery method of choice [PH, RM]. Time and availability were the key driving factors [RM]. Distance learning avoided the need to find staff to deliver internal training sessions, reduced the time necessary to find external seminars and allowed staff to study without locking them into work time [PH].

> *It's not as if you're having distance learning because you consider it is the best way of doing it. It's to get over the problem of people being at a distance. People don't generally eat tinned carrots because they prefer them. It's because they can't be bothered getting fresh ones, haven't the time or they are not available. Its starting point is that it is not as good as full-time education or training. It's to actually get over the constraints that prevent people from having a full-time education.* [PH]

The company's interest in technology-based delivery stemmed from a desire to enhance paper-based resources so that distance learning might supersede face-to-face methods.

> *Because it [CAL] pulls on the best technology we have got, it has potential advantages over the traditional way. You are taking something that is at a lower point than face-to-face education and developing it to the extent that it can overtake it.* [PH]

As such, this medium was perceived to offer many benefits. Firstly, CAL was "scaleable" [RM] with the potential to train hundreds of employees concurrently in different offices throughout the UK and overseas. Secondly, delivery was consistent. For example, the expert knowledge of some staff could be "bottled and packaged" either on interactive CD-ROMs [RM] or distributed on the Internet. Thirdly, as the company expanded into countries in different time zones, access could be shared at any time of the day - "the immediacy is there" [RM]. And finally "the pace at which someone can learn is down to them" [RM].

Both managers suggested that this degree of flexibility required individuals to adopt a more disciplined approach to their studies. However managers expected their staff to be able to manage concurrent events.

> *I can understand an argument that perhaps training and learning should not compete for time in a commercial environment. That said, all you can do is offer a level of support. If they can't do that [learning] for their own benefit then they wont be able to do it with concurrent events with clients.* [RM]

The request by participants for time slots in the day was derided.

> *If I was managing a class of 8 year olds I would agree... Training has many facets. How they [staff] manage their own time is important. We are employing professional people.* [PH]

Lack of feedback and limited interaction remained a concern with technology-based training. Video conferencing, it was argued, did not offer a practical solution. Past experiences suggested that communication was inhibited by the technology and a failure to see all those taking part i.e. "only 10% of communication is verbal" [RM].

It was posited that problem-based learning and case studies might succeed where technology fails in creating a more dynamic learning environment. In conclusion, a combination of internal training, external courses and CD-ROMs was considered to be the most effective way of promoting lifelong learning within the company. But as broadband becomes more widely available, so the balance between these delivery modes may change.

> *I'm looking at a scenario where connectivity is not a problem. Data transfer is not a problem. I think this sort of distance learning approach [CAL] is very powerful and it can compensate for a lot of shortcomings by adding quality.* [RM]

10.10 Summary

Coffrey (1998) refutes the suggestion that purpose-designed distance learning educational packages will save employers money and produce competence in the work-place. Conversely, it would be foolish, he believes, to reinforce the view that "real" training requires face-to-face contact.

The findings of the illuminative evaluation support Coffrey's recommendations. To gain maximum benefit from distance learning companies must integrate "occasional seminars" to promote the sharing of ideas, link distance learning to on-line training and provide opportunities for employers to apply their learning in a real, meaningful context. There is, however, a potential mismatch between management expectations and the learner's ability to cope with the conflicting demands of training and workplace commitments. The flexibility offered by CAL accentuates this problem. Learning may be important but it can easily be set aside for more urgent work related duties.

Chapter 11

Conclusions and recommendations

11.1 Introduction

This thesis is concerned with computer-aided learning in the built environment. Its aim is to determine the pedagogic effectiveness of distributed interactive multimedia in the delivery of postgraduate project management education and training. In order to assess the extent to which this aim has been achieved, the principal deliverables arising from this study are set against the stated research objectives (refer to Table 11.1). Following a review of the hypothesis and rationale underpinning the selection of project management, each of these objectives are addressed.

The development model described by Benyon *et al* (1997) provides a sound framework for the production of educational multimedia. His six stage process is used to convert a long established, high quality project management postgraduate module into a distributed multimedia interactive web-hybrid CD-ROM ($DIME^{PM}$). Although the evaluations' findings reveal limitations in the execution of Benyon *et al's* developmental model, it is contended that $DIME^{PM}$ enables a genuine comparison of alternative delivery modes to be made and leads to a greater understanding of the factors influencing the pedagogic effectiveness of CAL.

The conclusions, therefore, explore the rationale underpinning courseware specification and address pedagogic and multimedia design issues associated with the implementation of CAL prior to an evaluation of technology-based learning in a HE and organisational setting. Recommendations are made regarding future development of postgraduate educational programs.

Objectives	Deliverables
To review existing postgraduate provision and identify the key factors that influence the development of distance learning.	A survey of postgraduate course directors and academics responsible for delivery the UK built environment provision.
To select a pedagogic framework for the development of CAL programs.	An analysis of instructional design methodologies and an exposition of innovative delivery mechanisms allied to project management education.
To design, create and implement a distributed interactive multimedia educational program at postgraduate level.	The development of a novel project management web-hybrid CD-ROM (DIME^{PM}) informed by a survey of TLTP Phases 2 & 3 project co-ordinators. *(Chancellor's Award prize-winner in the category of Innovation in Teaching and Learning, 2000, LMU)*
To conduct a comparative longitudinal evaluation of student attitude, performance and confidence, arising from alternative delivery modes.	The implementation of an experimental pre post-test control group design, summative assessment and self-efficacy ratings.
To determine the issues that affect the quality of the learning experience in a HE and an industry context.	A multi-paradigmatic (i.e. hybrid) evaluation of DIME^{PM} in HE and an "illuminative" evaluation in an industry setting.
To develop a learning strategy that maximises the potential of distributed interactive multimedia.	A set of directions or guidelines that align CAL with course and training outcomes.

Table 11.1 Research objectives and deliverables

11.2 Hypothesis reviewed

The research hypothesis addressed in this thesis is:

> ***Distributed interactive multimedia is more effective than part-time or multiple-media distance learning in the delivery of postgraduate project management education and training?***

As such the hypothesis is rejected. Rather, the evaluation suggests that no one delivery mode can be "badged" as being the most effective, but that each lends itself to different learning needs. In other words, delivery is context specific. For example, technically orientated "hard" skills can be developed by an interactive CAL approach whereas softer interpersonal skills should be developed through face-to-face contact. The principal findings of the research are:

- The reluctance, expressed by many academics, in adopting CAL in postgraduate built environment education may be attributed to pedagogic concerns regarding distance learning;
- The concept of a behavioural-constructivist continuum is helpful in formulating an appropriate pedagogic design for CAL applications;
- Criticism of experimental educational evaluations may be countered by the use of hybrid designs that draw on qualitative and quantitative methodologies;
- Robust CAL applications require rigorous formative evaluation at the pre-implementation developmental stage;
- Translation of design guidelines into dynamic CAL resources relies on an amalgam of skills, namely, graphic design, software engineering and pedagogy;
- CAL applications should offer the user a variety of control features in order to accommodate the student's preferred learning style;
- Learner resistance to the use of asynchronous and synchronous communication via VLEs may be overcome by overt TLA strategies and the creation of identifiable student sets; and
- The flexibility and access afforded by CAL demands greater self-discipline from the learner in both HE and industry settings.

11.3 Managing change

IT and the concept of a learning society are at the forefront of many recent government and construction industry driven initiatives. These issues remain topical and are perceived to be of crucial importance in achieving continuous improvement. Support for the view that project management has a key role to play in delivering improved performance and satisfying the needs of construction clients can be found in a number of influential reports published in the 1990s. Accordingly the research focuses on the development and evaluation of a project management educational program.

Latham's interim report "*Trust and Money*" (1993) is widely regarded as having succeeded in identifying many of the problems endemic in the UK construction industry. Separation of the design process from the construction phase in the project life cycle and the proliferation of adversarial contractual conditions, were held responsible for creating an environment in which projects frequently suffered delay, exceeded budget and failed to satisfy performance requirements. The underlying reason for the industry's poor performance was attributed to fragmentation and poor management.

The Egan Report "*Rethinking Construction*" (1998) identified five drivers of change and, building on Latham's final report "*Constructing the Team*" and the Reading Construction Forum's best practice guides to partnering, suggested that strategic alliances offered a better opportunity than project partnering to draw together project stakeholders in the supply chain. Although Egan's views did not receive universal support from the industry, many authorities acknowledged that his report provided a catalyst for changing the culture in an industry so often criticised for its traditional practices. The CBPP and M^4I, who were charged with implementing Egan's recommendations, and other leading industry bodies (e.g. CIB, CIC and CITB) and many professional institutions (e.g. APM, CIOB, ICE and RICS), have been responsible for inculcating the philosophy of continuous improvement within the industry. Project management is not exempt from these changes. Arguably, the conventional view of project management is being superseded by the new concept of process management.

Of course, the pace of change experienced in recent years is not unique to the construction industry. Global competition and technological change are evident in many other sectors. The corollary of this, many authorities observe, is a general shift towards a knowledge-driven culture, from both a workforce and organisational perspective. Moreover there is renewed interest in alternative management practices and organisational structures. It has been argued that these influences should also be acknowledged as giving rise to a new paradigm in project management.

Many construction industry and professional bodies e.g. CIC and CIOB, recommend that project management education ought reasonably to be targeted at the experienced graduate. Anecdotal evidence suggests that there has indeed been a step-change in the demand for postgraduate provision. Growth in this area would seem entirely consistent with the reported expansion in postgraduate numbers experienced more broadly across the whole of HE sector (Harris Report, 1996) and the rise in status of lifelong learning within professional institutions. However, alternative pedagogic approaches are necessary to meet the needs of this new student profile i.e. the mature, part-time student who seeks to balance the conflicting demands of education with workplace and social commitments.

While it may seem rather trite to make reference to on-going educational change, HE cannot be excluded from the context in which this study is founded. HE has witnessed an undeniable shift towards a business-orientated culture. A combination of increased student demand, reductions in HEFCE unit funding and the need to diversify income streams, are forcing HEIs to adopt innovative, and hopefully more cost effective, flexible delivery mechanisms. Successful research bids and Research Assessment Exercise (RAE) funding are perceived as a means of providing much needed sources of income. Consequently, the response from some HEIs has been to intensify their research effort, while for others, a more radical change of direction away from teaching to research was necessary. Consultancy and in-company training offer further opportunities to increase revenue, but again such activity has the potential to dilute resources previously allocated to "main stream" teaching.

This study, therefore, seeks to determine the uptake of distance learning in the built environment and more specifically to review current practice in postgraduate education so as to inform the future development of innovative CAL delivery methods.

11.4 Postgraduate education in the built environment

A UK survey of postgraduate provision in the built environment reveals that recruitment on postgraduate courses does not reflect the envisaged high growth in demand. Course populations are skewed to the 0-25 banding with less than 5% of courses in the sample attracting over 100 students. Moreover, relatively little distance learning provision is available with only small pockets of computer-aided learning activity being identified by the survey. The strength of distance learning is perceived by course directors (or academics with direct responsibility for postgraduate provision) to be restricted principally to enhanced access and the ability to use learning resources for revision and future reference. The relative learner benefits of distance learning as opposed to part-time delivery are uncertain, with many respondents strongly disagreeing with the contention that distance delivery enhanced the student learning experience.

These findings are reinforced by respondents' observations regarding the problems associated with distance learning. The data is classified under the following headings: pedagogy; administration; and resources. Common concerns in the former category focus on the lack of face-to-face contact, student "isolation" and a general lack of motivation. It is also apparent that these problems are not unique to students. Tutors became detached from their students and were equally concerned by the lack of interaction. Secondly, the administrative burden created by this delivery mode was recognised as a major problem that often demands new institutional systems to track student progress and performance. Resource issues partially overlap this second category. Cost and time implications associated with the creation and distribution of distance learning materials are exacerbated by the need for continuous updating.

11.5 A pedagogic framework for the development of CAL

A review of literature in the field of project management education reveals many innovative approaches regarding the pedagogic development of the subject. Recent studies involve attempts to situate learning in the workplace and to contextualise learning through the use of case studies. While they do not "major" on delivery, they recognise that computer-aided training packages might influence the manner in which these approaches are implemented. However, one experimental study comparing the effectiveness of face-to-face instruction, self-directed learning and a stand-alone project management computer application, concludes that the success of interactive multimedia relies upon the use of conferencing facilities to encourage communication (Passerini, 2000).

Educational innovation has often been viewed in a technological context. Indeed the government, in seeking to promote the concept of a learning society, has invested heavily in CIT. Initial phases of the TLTP and FTLP programmes, although the source of some criticism, succeeded in heightening the awareness of academics to the potential of alternative media. But much development has been characterised by adhoc pilot programs or small-scale experiments. Largely due to the considerable investment required for the creation of CAL applications, programs have necessarily been "one-off projects" and as a consequence many academics remain sceptical as to whether the supposed potential of CIT can be fulfilled on a larger scale. Such reaction is understandable. However, much criticism of existing CAL applications seems to have been deflected with the advent of the Internet. Once again there appears to be a "panacea" and renewed energy is being invested in the development of web-based delivery that utilises so-called virtual learning environments and makes use of asynchronous and synchronous communication technologies. Enhancements in the quality of student learning experiences are once again anticipated.

The aforementioned UK survey not only uncovered little evidence of distance learning provision in the built environment but it also found limited use of computer-aided or web-based delivery. As it was not possible therefore to substantiate whether the supposed benefits of CAL were being achieved a further survey was conducted, drawing on the experience of those responsible for TLTP Phases 2 and 3 projects.

Encouragingly, respondents identified pedagogic issues as the principal driver of change. CAL was generally perceived to offer students the opportunity to learn at their own pace, to adopt a "discovery" approach to learning and to use materials later as a source of reference. Yet the relative effectiveness of this approach as compared to part-time delivery is less clear.

The survey indicates that a series of technical and cultural issues prevent CAL from gaining wider acceptance in the academic community. Technological issues such as bandwidth, compatibility and institutional infrastructure combined with student and staff resistance to change appear to be the major "barriers". Nevertheless it is generally acknowledged that there has been a shift of emphasis away from technical to pedagogic issues and that increased acceptance of CAL may be achieved through further research and the subsequent dissemination of good practice in this field.

11.6 Multimedia development

Criticism of adhoc CAL development abounds in academic journals. The one-off creations of enthusiasts are perceived to lack credibility and the flexibility to justify investment. The development of a robust educational program, it is submitted, relies on the talents of a varied range of disciplines, not least the graphic designer, who is able to translate design guidelines into a distinctive user-friendly product. Similarly it is unrealistic to expect that a multimedia developer should also possess both the pedagogic insight and programming expertise to produce truly interactive multimedia features.

Respondents to the aforementioned CAL survey highlight the importance of user control, navigation, interactivity and aesthetics. Accordingly, DIME^{PM} places emphasis on these components. Mimicking the familiar Sony "Play Station" console concept, navigation is centred on a bespoke control panel.

Authorware Attain, a popular authoring package with multimedia developers, provides a range of navigation and interactive features. Users can "jump" to pages, retrace their way through the resource and "call" on interactive routines associated with particular content. A variety of interactive exercises in DIME^{PM} enable users to practice their skills and gain feedback. Despite the heightened interest in web-based delivery, DIME^{PM} adopts a hybrid CD-ROM format. The decision is in part informed by the problems experienced by multimedia developers and in part influenced by the media rich nature of the content and publishers' copyright restrictions on specific topics within the module.

Pilot testing of web-packaged components supported the views of respondents to the CAL survey. Internet access can be prohibitively slow. Although high bandwidth using ASDL appears to offer a solution to many of the technical concerns associated with web-delivery, pricing policies and limited access to the service remain major barriers to its use in an educational setting.

Only content that required frequent updating e.g. assessment briefs, were made available on the Blackboard course web-site, together with a selection of text files, course information and hyperlinks to URLs. The site provided students with an opportunity to discuss aspects of the module via synchronous and asynchronous communication tools. Internet-based video conferencing could not be used due to institutional concerns regarding Firewall security. Consequently, this combination of CD-ROM/Internet delivery was perceived to mitigate some of the problems associated with standalone applications and facilitated feedback, enabled students to use on-line chat tools and allowed the tutor to monitor student involvement throughout the delivery period.

11.7 A comparative evaluation of delivery modes

Despite recurring criticism that experiments cannot determine whether learning is affected by the use of computer-aided learning applications (Gunn, 1997a), the views of Draper (1997) regarding the potential of comparative evaluations are persuasive in setting up a "hybrid" evaluation.

This approach is perceived, by Oliver (1997), to balance the seemingly conflicting requirements of producing generalisable results i.e. the pedagogic effectiveness of computer-aided learning, with the contextual, "situated" issues. Accordingly the evaluation methodology employed a variety of tools and a series of measures were introduced either to avoid or reduce some of the problems commonly associated with experimental research. The research study therefore attempts to make an objective assessment of the strengths and weaknesses of distributed interactive multimedia education, evaluating real students on a real course.

The comparative evaluation, as in the earlier work of Passerini (2000), relies upon each mode of delivery using identical content. Indeed this requirement was one of the principal reasons for the development of a bespoke project management package ($DIME^{PM}$). A longitudinal approach was adopted and in accordance with the hybrid evaluation methodology, data was collected in three semesters across two academic years. The approach reflects Kirkpatrick's (1967) evaluation hierarchy. Student "Reaction" was gained by means of a feedback questionnaire together with interest and involvement charts. "Learning Gain" was determined by a pre post-test control group design. Part-time (PT) delivery was the control with multiple media (MM) and $DIME^{PM}$ forming two experimental groups. "Behaviour" i.e. performance in a work setting, was gauged by a pseudo measure, namely a self-efficacy rating scale. The instrument utilised a 34 item scale based upon competencies and skills distilled from the APM BoK.

Although the PT and MM delivery modes necessitated some re-working of material content and presentation, the creation of $DIME^{PM}$ was entirely new and "un-tested" prior to the research study. This aspect of the evaluation was potentially problematic. A rigorous 12-step formative evaluation (Driscoll, 1998) was undertaken prior to the launch of $DIME^{PM}$ to ensure that the hybrid CD-ROM met the necessary quality standards.

Peer recognition in the form of a Chancellor's Award for Innovation in Teaching and Learning at Leeds Metropolitan University in 2000, lent further weight to the contention that DIME^{PM} was sufficiently robust for student use. Without such assurances the validity of an experiment of this nature would be open to justified criticism. Rather than evaluating the relative effectiveness of alternative delivery modes, the findings may otherwise reflect merely the inadequacies of a poorly designed experimental intervention.

Although pre post-tests reveal improvements in student performance in each of the three delivery modes, there is no significant difference between the groups. Similarly the median pre and post-self-efficacy ratings within the Project Management scale show an increase in confidence, but again Kruskall-Wallis test found no significant difference between alternative delivery modes. The results suggest therefore that the relative academic performance and confidence that postgraduate students possess in performing related tasks, are unaffected by the delivery mode. These findings must, however, be treated with caution. The elimination or control of extraneous variables in an educational setting is extremely difficult to achieve.

In this study, stratified samples were taken from a broad range of postgraduate courses, each possessing its own identity and course culture. However, the number of cases in the experimental design was only marginally in excess of the minimum specified in evaluation guidelines (Newton, 1998). Not that reservations such as these, are uncommon to many studies that seek to determine the effectiveness of educational interventions. They have prompted many authors to question the worth of evaluations per sé. Yet it is argued that research of this nature, while not in itself providing "answers", does add to a growing body of evidence regarding the appropriateness and best fit of instructional technology within educational programmes.

It is evident from Blackboard web-site usage statistics that students have not taken up the opportunities afforded by CMC. Although the principal form of communication is via email, the Blackboard web-site has been largely ignored. From the evidence it may be concluded that there is no perceived benefit to be gained by contacting peers in this manner.

However, this may be due to unfamiliarity with the technology or a lack of cohesion within the respective cohorts. It may also be due to the fact that there is no obvious reason why students should use these facilities. This is perceived to be a flaw in the pedagogic design of the educational program. Tutors should be responsible for providing a catalyst, perhaps a formative or summative collaborative task, and ensure that the students have an opportunity to develop their skills in the use of CMC prior to commencement of their academic studies.

Qualitative evaluation methodologies, in an educational context, are widely regarded as being able to provide a greater insight into the student experience than experimental studies. It is a view supported by the evaluation findings. Student reaction is consistent with the comments of respondents in the *Postgraduate Education* and *CAL* surveys. The evaluation charts show that interest in background or introductory material i.e. definitions, organisational structures and briefing, is seemingly unaffected by the delivery mode. The same is not true for "hard" skills i.e. planning, risk management and value management. Here multimedia delivery achieves higher average scores than either the control or MM experimental group. The latter shows a marked drop in interest.

Conversely, the "softer" skills such as communication and team working are of less interest to both experimental groups than PT delivery. Not only had the interpersonal skills guest lectures been particularly well received by PT students but also students from both experimental groups appeared to question the relevance and appropriateness of interpersonal skills in a distance learning course. These views appear to corroborate the findings of earlier research (Adams, 2000; Passerini, 2000). Interactive media seems capable of stimulating student interest in technical, content-driven subjects but less able to overcome the inherent lack of face-to-face contact when concepts such as interpersonal skills are being developed. It has been argued that this area of management is the most important aspect of the project manager's role and from the evidence it is most suited to face to face delivery.

Opinion is divided on whether or not CAL can provide enhanced access to learning. This problem, seemingly, is not peculiar to face-to-face delivery. PT students commented on the difficulties in attending sessions and accessing information. MM students experienced problems gaining remote access to resources and DIME^{PM} students found that internet-based and CD-ROM materials imposed restrictions on available study time. Put simply, they had to have access to a computer. Restrictions on the use of PCs in the work place compounded difficulties for students.

What the above shows is that extrinsic factors, such as the learning environment, have a major impact upon an individual's attitude to CAL. This view is supported by Gunn (1998), who argues that an evaluation "of context" is essential. Subsequent evaluation of DIME^{PM} is prompted by these observations. In addition to determining the pedagogic effectiveness of DIME^{PM} in a HE environment, there is perceived to be a need to identify issues that might affect the learning benefits of technology-based educational programs in an industry setting.

11.8 CAL in an organisational setting

An illuminative methodology is adopted and depth interviews with a representative sample of employees within a national engineering consultancy are undertaken in this qualitative evaluation. The evaluation may be regarded in effect to be Kirkpatrick's (1967) fourth level "Results" evaluation and as such can be used to gauge the wider impact of an educational intervention within an organisation.

Time and availability are perceived to be the principal "drivers" for the investment of resources in distance learning. As a vehicle for learning it is construed as a second class delivery method, offering fewer pedagogic advantages than traditional face-to-face teaching. The constraints imposed by a commercial environment, while not in direct conflict with the philosophy of lifelong learning, do limit the opportunities for staff to take "time out" to pursue studies. Consequently distance learning, at times, provides the sole, rather than the preferred, way of developing skills and understanding.

Computer-aided learning challenges these stereotypes and, in this study, prompts managers to seek new ways of enhancing the effectiveness of distance learning. The evaluation suggests that the flexibility afforded by CAL i.e. in allowing study at varying pace in or away from the workplace, requires greater discipline on the part of the learner than face-to-face delivery, as work commitments generally take priority over learning. From the evidence it can be concluded that employees often find it difficult to juggle job-related tasks with learning in a busy office environment, despite support from senior managers.

Learning, however, assumes greater importance when it is perceived to be relevant to the workplace, although the definition as to what is and is not relevant is unclear. In addition to technical job specific training, managers feel that educational programmes should "broaden" and "round" individuals (provided always that it is aligned with commercial needs). Likewise, individuals share the view that training should be relevant. Their motivation for pursuing courses stems from a desire to enhance career progression, to update skills and knowledge and to satisfy interest. Not only might training benefit the organisation but it may also assist in reducing staff turnover.

Case studies and the use of authentic project-based assessment seem suited to in-company learning, providing both a context and a real-life "feel" to academic studies. The integration of various forms of media and interactive exercises are clearly associated with expressions of interest, enjoyment and even excitement. The importance of instructional design is reinforced by these observations. Structure, learning preference, interactivity, research and feedback emerge as the key issues. However, participants' reaction to specific features in DIME^{PM} is mixed. There is little consistency here. It is concluded that variety in form and functionality is needed if learners are not to become disenchanted with CAL.

Although participants were familiar with the Internet and had some experience of video conferencing, all were reluctant to make use of the VLE. What their arguments show is that electronic communication will only be accepted if learners are comfortable with the technology. This relies on future technological development and functionality and is also dependent upon a change of culture in communication.

In summary the evaluation reinforces the view that CAL should not be viewed as an "either or" option. The dichotomy between distance and traditional learning is artificial. Each delivery mode has something to offer and effective learning will best be achieved by adopting an integrated approach, playing to the advantages of traditional face-to-face delivery, distance learning and CAL.

11.9 Implications for learning, teaching and assessment strategies

The benefits associated with PT delivery, unsurprisingly, focus on personal contact, either through time-tabled group activities or more informal social interaction. The strengths of MM and DIME^{PM} are concerned with presentation, structure and consistency. Positive reflections on the learning experience tend to concentrate on the pace and flexibility of the learning programme. The various forms of media and the use of interactive exercises in DIME^{PM} are appreciated by many, but these same users are often uncomfortable learning from a screen, preferring to have recourse to text on a page. Once again there are similarities with Passerini's (2000) work. There are distinct problems associated with distance learning per sé. The feeling of isolation, being distant both physically and psychologically from tutors, has an impact on motivation. The discipline required of students undertaking distance learning, either in MM or DIME^{PM} format, is far greater and not necessarily suited to the learning style of the individual. Table 11.2 summarises the principal advantages and disadvantages of each delivery mode.

There are a number of conclusions to be made. The human side of the learning experience must not be under estimated. It is posited that social issues remain a key factor in student recruitment and retention. For some students the mode of delivery may be "out of step" with other aspects of their studies. Attention must be focused on integration issues. Flexibility is a doubled-sided coin. On the one side it offers learners the opportunity to study at their own pace wherever they choose. On the other side it allows users to prioritise competing commitments. Consequently distance learning requires a greater discipline on the part of the learner. Such contextual issues cloud the findings of the quantitative evaluation but also serve to reinforce the need to acknowledge the preferences of the student and the inherent limitations of distance learning delivery.

	Delivery modes		
	In-class instruction - Part time (PT)	Distance learning - Multiple-media (MM)	Distributed interactive multimedia -DIME^{PM}
Media	Study guide; lectures; debates; management games	Study guide; audio; video	CD-ROM including audio & video; Internet
Advantages	Motivation Social interaction Group working Feedback Face-to-face "Soft" skills	Variety Pace of learning Consistency Structure Flexibility	Integrated resources Presentation Consistency Interactivity Flexibility Web-capability "Hard" skills
Disadvantages	Mixed cohorts Documentation Access - physical Variable delivery	Web access Motivation Feedback "Soft" skills	Access - PC/Internet Motivation Feedback Compatibility Culture "Soft" skills

Table 11.2 A summary of advantages and disadvantages of alternative delivery modes

An Associated Delivery Model (ADM) is proposed (refer to Figure 11.1) that recognises these imperatives. If one accepts the premise that CAL is inappropriate for the development "softer skills" and that technology-based applications are best suited to the delivery of technical content then the CAL/Traditional interface will be dependent upon the relative pressure brought about by pedagogic, institutional and student-centred factors. As such the model is more responsive than the so-called 80/20 model adopted by Harrod and Townsend (1998) in which 20% of learning occurs in face-to-face seminars and 80% occurs as a result of independent group study. Much depends on context.

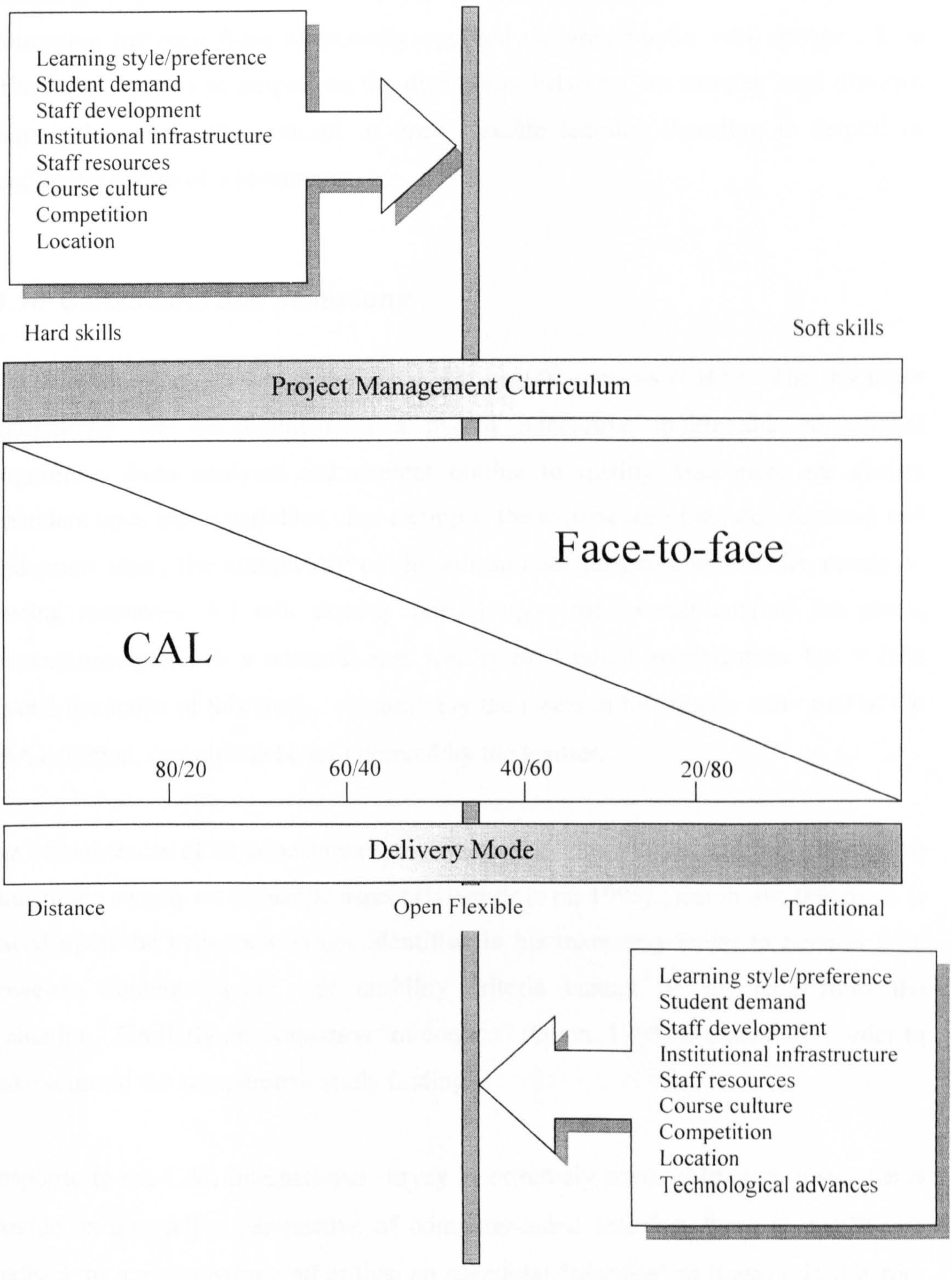

Figure 11.1 Associated Delivery Model

The relationship must not be viewed as being static. As interactive communications technology improves and cultural issues associated with its use are overcome the relationship between these supposedly opposed delivery modes will change. It is perhaps rather naïve to perpetuate the dichotomy between "on-campus" and distance learning delivery. The concept of open flexible learning therefore is helpful in creating the notion of a continuum.

11.10 Constraints and limitations

This study does not seek to undertake a cost benefit analysis (CBA). The resources required for the development of a hybrid interactive multimedia educational programme, from analysis and content outline to quality assurance, are clearly dependent upon many variables. For example, the experience of the development and production team, the complexity of the educational programme and the access to existing resources. All will directly impact upon the overall cost of the piece. Unquestionably this is a research area worthy of detailed investigation, but it falls beyond the scope of this study. Accordingly the research focuses on latter part of the CBA equation, namely the benefit derived by the learner.

The effectiveness of an educational programme has many facets and there is need to concentrate a study on a specific aspect (Edwards *et al,* 1995). Emphasis, therefore, is placed upon the pedagogic issues identified in his taxonomy (refer to Section 8.2). However, content, layout and usability criteria cannot be divorced from the evaluation. Similarly an evaluation "of context" (Gunn, 1998) is essential in order to make sense of the comparative study findings.

Response to the CAL international survey is extremely poor. Although respondents provide an alternative perspective of computer-aided learning, there is insufficient feedback to report anything other than an anecdotal "reaction" to issues raised earlier with multimedia developers in the United Kingdom.

It should also be recognised that instructional design is constrained by both the delivery technology and the authoring tools available (Benyon *et al*, 1997). At the commencement of the research study the necessary technological infrastructure was not in place to stream video and audio media. Although pilot testing continued throughout the research period, implementation of the distributed multimedia resource proceeded as a web-hybrid CD-ROM in order to overcome operational difficulties associated with the distribution of large media rich files.

Authorware prompts the developer to embrace interactivity. Whilst DIME^{PM} mimics all the student activities in both the MM and PT versions of the Project Management module it is acknowledged that these routines could be developed further to enhance the interactive "feel" of the program. Moreover, Authorware's in-built CMI functions could be used to track student progress in a web-packaged version of DIME^{PM}.

The design of the experimental evaluation was problematic. Neither random allocation nor paired testing of students was adopted during the three-semester evaluation period. Failure to gain approval for the simultaneous delivery of part-time and distance learning together with the size of student cohorts prohibited the use of a true experimental design. Hence the quasi-experimental format made use of stratified samples to reduce threats to internal validity. Further difficulties in assessing the effectiveness of the independent variable were created by the early loss of subjects from the evaluation. While this phenomenon is not unusual within the School, it undermined the attempts to create common group profiles. Marchant suggests (2001) that such loss need not necessarily result in subjects being excluded from the analysis[1]. However, due to the limitations stated above, this approach was not pursued.

The longitudinal approach adopted in this study does not extend to Kirkpatrick's (1967) "Results" level. Although this weakness is partially addressed by the subsequent evaluation of DIME^{PM} in an organisational setting, it must be accepted that the quasi "4th level" evaluation (Kirkpatrick, 1967) is not undertaken using the same HE student sample.

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[1] Matthews (2000) refers to this dictum as analysis by "intention-to-treat".

Moreover, participants were not required to enrol on the Project Management module. They did not submit summative assessments and were not expected to fully engage with the programme of study.

It is submitted that an organisational perspective of CAL can be achieved by means of an illuminative evaluation. However, the industry-sponsored evaluation, in this study, is limited to the views of six participants each having been allocated two working days to complete the exercise, due to externally imposed resource constraints. Therefore the sought after "real" learning environment is not present. Rather, there is an air of artificiality that conflicts with the case study based research methodology. Furthermore there is difficulty in generalising the results that arise from the illuminative study. This, however, is a problem common to such approaches and must be balanced against the benefits derived from formative evaluations, which highlight the issues and explain the causes.

11.11 Recommendations

A student-centred evaluation methodology has been adopted throughout this study. Pedagogic effectiveness necessarily embraces academic achievement, personal development and student "reaction" to the delivery mode. The impact of new technology on the academic has largely been ignored. However, the postgraduate survey of course directors hints at some important issues that demand further investigation. So-called "facilitators" and "barriers" to learning, it is argued, are equally relevant to those who deliver and administer educational or training programmes. Indeed the role of the tutor, as perceived by the academic, may assist in refining further appropriate pedagogic methodologies. Many questions flow from this line of investigation: How does CMC affect the tutor/student relationship? Does CAL undermine the status of the tutor? What impact does CAL have upon tutor motivation and ownership?

Limitations in the functionality and design of DIME^{PM} are arguably as much a reflection on institutional educational development strategies as they are on the abilities of the multimedia development team. Successful conversion of existing materials into CAL/web-based delivery is not achieved merely through technological competence. It relies on a well thought-out pedagogic strategy that acknowledges the need to motivate and involve the student and academic staff alike. Academic staff must therefore be convinced that CAL can provide a high quality learning experience, that the motives behind such development are not driven solely by financial motives and that by integrating CAL into existing programmes, students will derive additional benefit. Awareness should be promoted jointly by the enthusiast and by "top down" well informed staff development programmes.

High quality educational resources available on the Internet are frequently protected by identification codes. Although ATHENS authentication has assisted in simplifying access to such resources, sometimes from remote locations, full-text academic journals frequently require a myriad of user names and passwords. The experience can be bewildering and it is contended can serve to dissuade users from thoroughly researching valuable data sources. Rather, the inexperienced web-user may be content to "surf the Internet" and, unfortunately, be the recipient of misinformation. Institutions should be alert to these problems and endeavour to simplify further electronic access procedures for "on-campus" and distance learning students alike.

Thorough formative evaluation aimed at mitigating the risks associated with novel technology-based applications is an essential aspect of Benyon *et al* (1997) developmental model. The reasons for rigorous testing of CAL programs are twofold. Firstly, from an ethical standpoint, students should receive a high quality, robust learning package that satisfies the stated educational outcomes. Secondly, the occurrence of even a small number of technical flaws e.g. unfound URLs and failed media links, is a distraction for some students that may subsequently confound research findings.

Evaluations can also intrude upon the student learning experience, therefore great care should be taken in the selection, number and timing of the implementation of evaluation instruments. Pre-tests, in particular, may severely de-motivate students. It is imperative that students are reassured and thoroughly briefed regarding the precise purpose of the study.

Both pedagogic considerations and resource constraints demand that CAL be targeted at appropriate areas of study. The findings of this research suggest that CAL is less able to develop an understanding of interpersonal issues such as team working and communication, than tutor-led sessions delivered face-to-face with the student. Technical, largely content-driven, subjects are more suited to CAL. It is recommended that educational programmes, that incorporate a range of "hard" and "soft" skills, adopt an open distance learning design. Such an approach, it is contended, may satisfy demand for increased tutor contact, offer greater opportunity for feedback and enhance student motivation.

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APPENDICES

Appendix

TEXT BOUND INTO THE SPINE

Postgraduate Education in the Built Environment

A comparative evaluation of alternative delivery modes

Administration only A

This questionnaire is to be completed by the course leader (or equivalent) for the named award(s) identified on the covering letter. The response will inform research into the pedagogic effectiveness of alternative delivery modes at postgraduate level.

The respondent is assured of confidentiality - any identifying information will be destroyed at the data processing stage of the research.

About the course

Delivery mode (please tick box(es))

1 ☐ Part-time
2 ☐ Full-time
3 ☐ Distance learning
4 ☐ Open learning
5 ☐ Other Please specify _____

In what year was the first intake of students on the course? 19__

Total student numbers currently on the course in all delivery modes (please tick box)

1 ☐ Under 25
2 ☐ 26 - 50
3 ☐ 51 - 75
4 ☐ 76 - 100
5 ☐ Over 100

Please go to Question 18 if no part of the course is delivered in distance learning mode

Distance learning

What type(s) of learning medium is used for distance learning? (please tick box(es))

1 ☐ Text (including still graphics)
2 ☐ Audio
3 ☐ Video
4 ☐ Computing
5 ☐ Other Please specify _____

How important were the following factors in the decision to develop distance learning? Please rank 1 = LEAST IMPORTANT 6 = MOST IMPORTANT

Student access
Unit cost per student
Pedagogic needs of students
Organisational support
Novelty of delivery mode
Speed of implementation

Please tick if you are unable to rank the factors in Question 5

0 ☐ Don't know

What are the student benefits of distance learning? (Please tick the box that most closely corresponds to your view)

		Strongly Disagree				Strongly Agree	Don't know
a	All students receive a consistent message	1	2	3	4	5	0
b	Students learn more than in Part Time (PT) mode	1	2	3	4	5	0
c	Students learn more quickly than in PT mode	1	2	3	4	5	0
d	Student knowledge retention is greater than in PT mode	1	2	3	4	5	0
e	Students can study at a time that best suits them	1	2	3	4	5	0
f	Students can use learning material for future reference	1	2	3	4	5	0
g	Students can use learning material for revision	1	2	3	4	5	0
h	Students can learn by discovery	1	2	3	4	5	0
i	Students can learn at their own pace	1	2	3	4	5	0
j	Students can make mistakes in private	1	2	3	4	5	0
k	Students can only study what they don't already know	1	2	3	4	5	0
l	Students do not need to travel to host institutions	1	2	3	4	5	0

What problems are associated with distance learning?

Which forms of communication are most frequently used by students to contact staff? (Please rank 1 = LEAST USED 6 = MOST USED)

Telephone
letter
Asynchronous computer-aided communication e.g. email
FAX
Synchronous computer-aided communication e.g.video conferencing
Face-to-face

Please go to Question 21 if you do not deliver any part of the course using Computer-aided learning techniques.

Computer-aided Learning (CAL)

How is the CAL component(s) delivered? (Please tick box(es))

1 ☐ Off-line
2 ☐ On-line
0 ☐ Don't know

) Are students given the facility to print a paper copy of the learning material from the CAL component(s)? (Please tick box)

1 ☐ Yes
2 ☐ No
0 ☐ Don't know

To what extent has the CAL component(s) <u>on the course</u> achieved the following benefits? (Please tick the box that most closely corresponds to your view)

	Strongly Disagree				Strongly Agree	Don't know
a All students receive a consistent message	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
b Students learn more than in Part Time (PT) mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
c Students learn more quickly than in PT mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
d Student knowledge retention is greater than in PT mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
e Students can study at a time that best suits them	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
f Students can use learning material for future reference	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
g Students can use learning material for revision	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
h Students can learn by discovery	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
i Students can learn at their own pace	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
j Students can make mistakes in private	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
k Students can only study what they don't already know	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
l Students do not need to travel to host institutions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐

2(a) Have you experienced problems with CAL provision? (Please tick box)

1 ☐ Yes
2 ☐ No
0 ☐ Don't know

(b) If you answered Yes to Question 12(a) please indicate the nature of the problem(s) below:

What is the minimum specification for delivering the CAL component(s) of the course?

a Operating system _____
b Processor _____
c RAM _____
d Hard disk space _____
e CD-Rom speed _____
f Display resolution _____
g Audio _____

Please tick if you are unable to identify the software used to deliver CAL in Question 13

0 ☐ Don't know

(a) Which authoring software has been used to create CAL material? (Please tick box(es))

1 ☐ Macromedia Director
2 ☐ Authorware Professional
3 ☐ Asymetrix Toolbook
4 ☐ HyperCard
5 ☐ SuperCard
6 ☐ IconAuthor
7 ☐ WebCT
8 ☐ Lotus Notes
9 ☐ Blackboard
10 ☐ Learning Space
11 ☐ Other Please specify _____

Please tick if you are unable to identify the software used to create the CAL material in Question 14(a)

0 ☐ Don't know

(b) Please give your reasons for the choice of software in Question 14(a)

Which technologies are used to deliver the CAL component(s)? (Please tick box(es))

1 ☐ 3.5 inch disk
2 ☐ CDRom
3 ☐ DVD
4 ☐ World Wide Web
5 ☐ Interactive video
6 ☐ Other Please specify _____

Please tick if you are unable to identify the technology used in Question 15

0 ☐ Don't know

Which forms of student-to-student communication are used in the CAL component(s)? (Please tick box(es))

1 ☐ Email
2 ☐ Bulletin boards
3 ☐ Computer conferencing
4 ☐ Other Please specify _____

Please tick if you are unable to identify the student-to-student communication in Question 16

0 ☐ Don't know

How important are the following features in a CAL environment? (Please tick the box that most closely corresponds to your view)

	Not Important				Very Important
a Navigation	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
b Help facilities	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
c Bookmarks	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
d Aesthetics	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
e Student control	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
f Interactivity	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
g Feedback	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
h Consistency	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
i Student Notes	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
j Speed	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
k Direct updating by staff	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
l Self-assessment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
m Multimedia	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
n Student tracking	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
o On-line assessment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Please go to Question 22

Future Development of Distance Learning Resources

(a) Has the course team plans to develop distance learning materials for the course prior to October 2002? (Please tick box)

1 ☐ Yes
0 ☐ No

(b) How important are the following factors in the course team's decision in Question 18(a)? (Please rank 1 = LEAST IMPORTANT 6 = MOST IMPORTANT)

Student access
Unit cost per student
Pedagogic needs of students
Organisational support
Novelty of delivery mode
Speed of implementation

Please tick if you are unable to rank the factors in Question 18(b)

0 ☐ Don't know

What are the student benefits of distance learning? (Please tick the box that most closely corresponds to your view)

		Strongly Disagree					Strongly Agree	Don't know
a	All students receive a consistent message	1	2	3	4	5		0
b	Students learn more than in Part Time (PT) mode	1	2	3	4	5		0
c	Students learn more quickly than in PT mode	1	2	3	4	5		0
d	Student knowledge retention is greater than in PT mode	1	2	3	4	5		0
e	Students can study at a time that best suits them	1	2	3	4	5		0
f	Students can use learning material for future reference	1	2	3	4	5		0
g	Students can use learning material for revision	1	2	3	4	5		0
h	Students can learn by discovery	1	2	3	4	5		0
i	Students can learn at their own pace	1	2	3	4	5		0
j	Students can make mistakes in private	1	2	3	4	5		0
k	Students can only study what they don't already know	1	2	3	4	5		0
l	Students do not need to travel to host institutions	1	2	3	4	5		0

What are the problems associated with distance learning?

(a) Has the course team plans to develop Computer-aided learning material for use on the course prior to October 2002? (Please tick box)

1 Yes
0 No

(b) What are the reasons for the course team's decision in Question 21(a)?

Course Evaluation

Which technique(s) do you use to evaluate the course? (Please tick appropriate box(es))

[1] ☐ Questionnaire
[2] ☐ Focus groups
[3] ☐ Pre-tests
[4] ☐ Post-tests
[5] ☐ Observation
[6] ☐ Inventory
[7] ☐ Critical incident log
[8] ☐ Other Please specify _____
_____
_____
_____

Would you be prepared to be interviewed on the topics raised in this questionnaire?

[1] ☐ Yes
[0] ☐ No

Would you like a summary of the research findings?

[1] ☐ Yes
[0] ☐ No

If you answered Yes to Question 23 or 24 above, please write your name and contact details below:

Surname _____
First name _____
Address _____
_____
_____
_____
Post Code _____
Telephone No. _____
FAX _____
Email _____

Please return this questionnaire in the stamped addressed envelope provided.

THANK YOU

Robert Ellis BSc(Hons) MSc FRICS MCIArb, School of the Built Environment,
Faculty of Health and Environment, Leeds Metropolitan University, Brunswick Building, Leeds, LS2 8BU

Computer-aided Learning

A review of alternative delivery modes

Administration only A

This questionnaire is to be completed by academics experienced in the development of computer-aided educational resources. The response will inform research into the pedagogic effectiveness of alternative delivery modes.

The respondent is assured of confidentiality - any identifying information will be destroyed at the data processing stage of the research.

Current activity

Are you currently developing computer-aided learning (CAL) resources? (Please tick box)

1 ☐ Yes
0 ☐ No

If you answered No to Question 1 please go to Question 11

Who is the intended audience for the CAL resources? (Please tick box(es))

1 ☐ First year undergraduate
2 ☐ Second year undergraduate
3 ☐ Final level undergraduate
4 ☐ Postgraduate
5 ☐ Other Please specify

How are the CAL resource(s) to be delivered? (Please tick box(es))

1 ☐ Off-line
2 ☐ On-line

Briefly describe the CAL resources

_____

_____

_____

_____

_____

_____

How important were the following factors (identified by Bates (1995) Technology, Open Learning and Distance Education, Routledge) in your decision to develop CAL resources? Please rank 1 = LEAST IMPORTANT 6 = MOST IMPORTANT

Student access
Unit cost per student
Pedagogic needs of students
Organisational support
Novelty of delivery mode
Speed of implementation

Technical considerations

Which authoring software are you currently using to create CAL resources? (Please tick box(es))

1 ☐ Macromedia Director
2 ☐ Authorware Professional
3 ☐ Asymetrix Toolbook
4 ☐ HyperCard
5 ☐ SuperCard
6 ☐ IconAuthor
7 ☐ WebCT
8 ☐ Lotus Notes
9 ☐ Blackboard
10 ☐ Learning Space
11 ☐ Other Please specify _____

_____

_____

_____

7 How do you intend to deliver the CAL resource(s)? (Please tick box(es))

1 ☐ 3.5 inch disk
2 ☐ CDRom
3 ☐ DVD
4 ☐ World Wide Web
5 ☐ Interactive video
6 ☐ Other Please specify _____

8 Do you intend to give students the facility to print a paper copy of the learning material from the CAL resource(s)? (Please tick box)

1 ☐ Yes
2 ☐ No
0 ☐ Not applicable

9a Is the resource to be delivered to distance learning students? (Please tick box)

1 ☐ Yes
2 ☐ No
0 ☐ Not applicable

b If you answered Yes to Question 9a, which form(s) of student-to-student communication do you intend to use? (Please tick box(es))

1 ☐ Email
2 ☐ Bulletin board
3 ☐ Computer conferencing
4 ☐ Other Please specify _____

If you were to commence the design of a new CAL resource for postgraduate use, what would you regard as being the minimum end-user computer system?

a Operating system _____
b Processor _____
c RAM _____
d Hard disk space _____
e CD-Rom speed _____
f Display resolution _____
g Audio _____
h Modem _____

Please tick if you are unable to specify the minimum end user system in Question 10
0 ☐

Value of CAL

To what extent do you believe that CAL can achieve the following benefits at postgraduate level? (Please tick the box that most closely corresponds to your view)

	Strongly Disagree				Strongly Agree	Don't know
a All students receive a consistent message	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
b Students learn more than in Part Time (PT) mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
c Students learn more quickly than in PT mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
d Student knowledge retention is greater than in PT mode	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
e Students can study at a time that best suits them	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
f Students can use learning material for future reference	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
g Students can use learning material for revision	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
h Students can learn by discovery	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
i Students can learn at their own pace	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
j Students can make mistakes in private	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
k Students can only study what they don't already know	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐
l Students do not need to travel to host institutions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	0 ☐

a Have you experienced problems with CAL provision? (Please tick box)

1 ☐ Yes
0 ☐ No

b If you answered Yes to Question 12a please indicate the nature of the problem(s)?

_____
_____
_____
_____
_____
_____
_____

How important are the following features in a CAL environment? (Please tick the box that most closely corresponds to your view)

		Not Important				Very Important	Don't know
a	Navigation	1	2	3	4	5	0
b	Help facilities	1	2	3	4	5	0
c	Bookmarks	1	2	3	4	5	0
d	Aesthetics	1	2	3	4	5	0
e	Student control	1	2	3	4	5	0
f	Interactivity	1	2	3	4	5	0
g	Feedback	1	2	3	4	5	0
h	Consistency	1	2	3	4	5	0
i	Student Notes	1	2	3	4	5	0
j	Speed	1	2	3	4	5	0
k	Direct updating by staff	1	2	3	4	5	0
l	Self-assessment	1	2	3	4	5	0
m	Multimedia	1	2	3	4	5	0
n	Student tracking	1	2	3	4	5	0
o	On-line assessment	1	2	3	4	5	0

Future Development of CAL

How do you think CAL delivery will change in the next five years?

Would you be prepared to be interviewed on the topics raised in this questionnaire?

1 ☐ Yes
0 ☐ No

Would you like a summary of the research findings?

1 ☐ Yes
0 ☐ No

If you answered Yes to Question 15 or 16 above, please write your name and contact details below:

Surname _____
First name _____
Address _____
_____
_____
_____
Post Code _____
Telephone No. _____
FAX _____
Email _____

Please return this questionnaire in the stamped addressed envelope provided.

THANK YOU

t Ellis BSc(Hons) MSc FRICS MCIArb, School of the Built Environment,
y of Health and Environment, Leeds Metropolitan University, Brunswick Building, Leeds, LS2

LEEDS METROPOLITAN UNIVERSITY

Self-efficacy

Student ID: ..... Mode: FT PT DL CAL delete as necessary

Self-efficacy has been defined as "the conviction that one can successfully execute the behaviour required to produce the outcomes" (Bandura, 1977).

Method

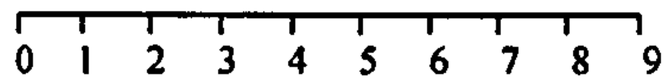
For each of the activities described in the questionnaire, consider yourself when making your very best effort. Please estimate the extent to which you would be confident of your capability to successfully complete the following activities on a regular basis. Give your estimation of confidence a numerical rating, using the scale on the right hand side of each activity.

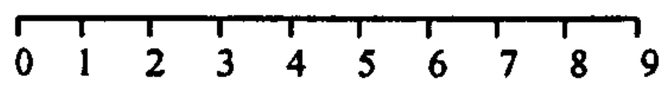
LIST OF ACTIVITIES

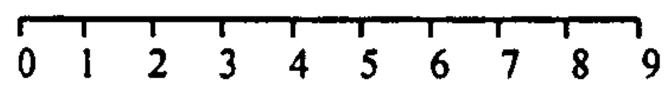
Please circle the appropriate numerical rating

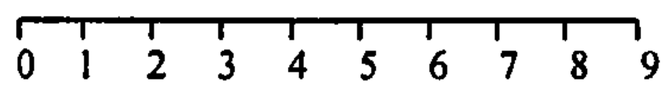
	No Confidence → Complete Confidence
1. Apply project management techniques and concepts in the realisation of a project	0 1 2 3 4 5 6 7 8 9
2. Identify the environmental factors e.g. economic, social, cultural, political and ethical, which impact upon a project	0 1 2 3 4 5 6 7 8 9
3. Prepare a strategic plan for a project in at least one industry	0 1 2 3 4 5 6 7 8 9
4. Translate client requirements into a project brief	0 1 2 3 4 5 6 7 8 9
5. Design and establish a range of organisations for projects of different sizes and degrees of complexity	0 1 2 3 4 5 6 7 8 9
6. Use and prepare a Work Breakdown Structure for a variety of projects	0 1 2 3 4 5 6 7 8 9
7. Plan the various stages of a complex major project	0 1 2 3 4 5 6 7 8 9
8. Draft a framework for the ongoing reference and control of the project process	0 1 2 3 4 5 6 7 8 9
9. Establish and maintain a vision of the project objectives	0 1 2 3 4 5 6 7 8 9

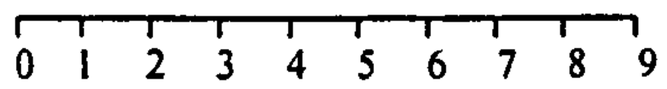
No Confidence — Complete Confidence

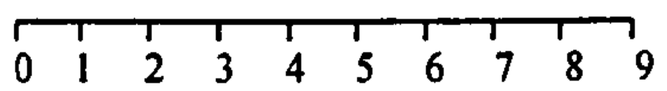
10. Draft project documents in an appropriate format 

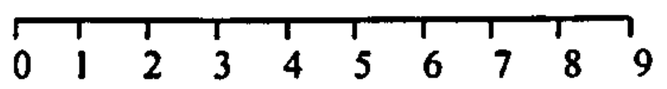
11. Communicate complex arguments effectively in a short period of time 

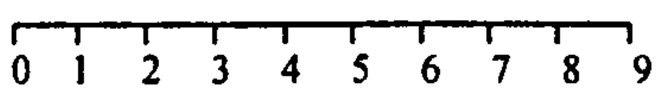
12. Define goals and objectives in difficult situations 

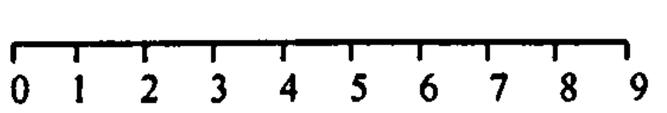
13. Get people to work and achieve goals and objectives in difficult situations 

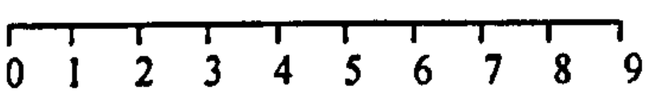
14. Use project risk analysis and management on many different types of project 

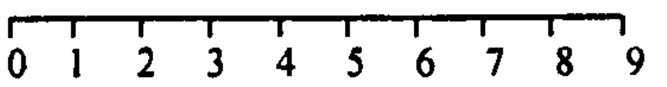
15. Implement a variety of value management methods 

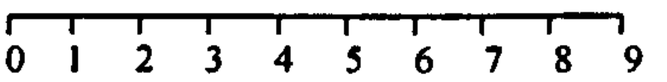
16. Prepare a project brief that gives a clear direction on the relative balance between the conflicting parameters of Time, Cost and Quality/Function 

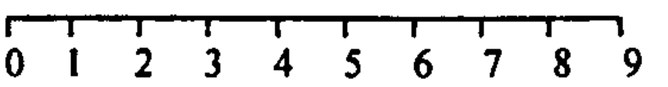
17. Advise on the organisational and contractual options for allocating risk 

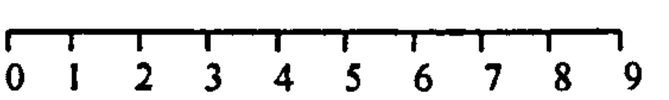
18. Satisfy the social and political constraints within the project strategy 

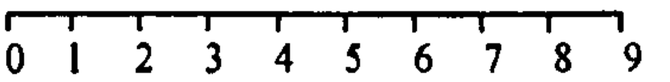
19. Develop, document and maintain the project brief as an accurate and comprehensive statement of the client's requirements 

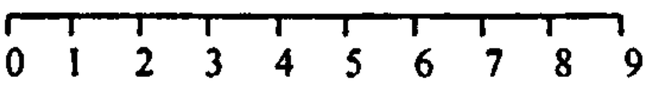
20. Manage the preparation of the client brief 

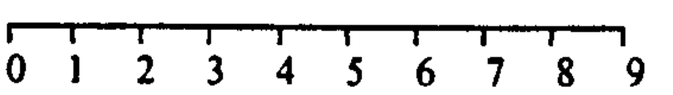
21. Develop a project procurement strategy 

22. Define the structure of the project team 

23. Define clearly the roles and responsibilities of team members 

24. Draft concise, accurate and relevant written communication for all levels in the project team 

25. Formulate and present ideas at all levels in the project 

26. Deliver effective verbal communication at all levels in the project team from strategy meetings with the client through formal briefings to routine progress meetings 

No Confidence — Complete Confidenc

27. Determine the duties and responsibilities in law of the parties to a contract

28. Advise upon the principal forms of contract which are used in the procurement of services for a project

29. Minimise conflict and direct all parties efforts towards achieving the project goals

30. Integrate teams of different specialist groups, possibly in conflicting situations and involving large projects to achieve a successfully integrated final product

31. Delegate a substantial proportion of project work to others

32. Resolve conflict in projects

33. Prepare contract documentation and develop a supplier acquisition plan

34. Identify what (standards, performance, requirements) the customer really wants

0 1 2 3 4 5 6 7 8 9

Many thanks for taking part in the self-efficacy evaluation. Please return this form to:

Robert Ellis
Principal Lecturer

LEEDS METROPOLITAN UNIVERSITY

"Project Management" Module Evaluation
Pre-test

Student ID: ..... Mode: FT PT DL CAL delete as necessary

To be completed prior to commencement of the module and returned to module tutor

The development of the postgraduate Project Management module has been part funded by the University's "Open Flexible Learning Project: Phase 3" (OFL3). The project seeks to determine the effectiveness of the support systems in the University. Independent research is also being undertaken to evaluate the effectiveness of learning resources delivered in a variety of different modes i.e. part-time, open and distributed multimedia.

In order to satisfy the University's requirements and to provide empirical data for the separate research study, a comparative longitudinal evaluation is to be conducted. Academic staff have undertaken a formative evaluation of the design and methods adopted in the module and we are seeking your support in the evaluation of the training you receive.

The objectives of this aspect of the evaluation are:

- To determine the participants' impressions about their education i.e. Reaction;
- To measure the learning gain achieved by the educational programme i.e. Learning; and
- To assess the extent to which learning has been generalised to the work situation i.e. Behaviour

The methods used to conduct the evaluation are:

- Focus groups;
- "Interest and Involvement" graphs
- Pre and post-testing; and
- Self-efficacy rating

The variety of evaluation methods used should generate comparative data that addresses specific questions and detects unexpected results through open-ended questions.

These methods are designed to evaluate the module and not to evaluate the individual students. The results from the tests do not form a part of the formal assessment for this module.

1. What is the difference between project management and general management?

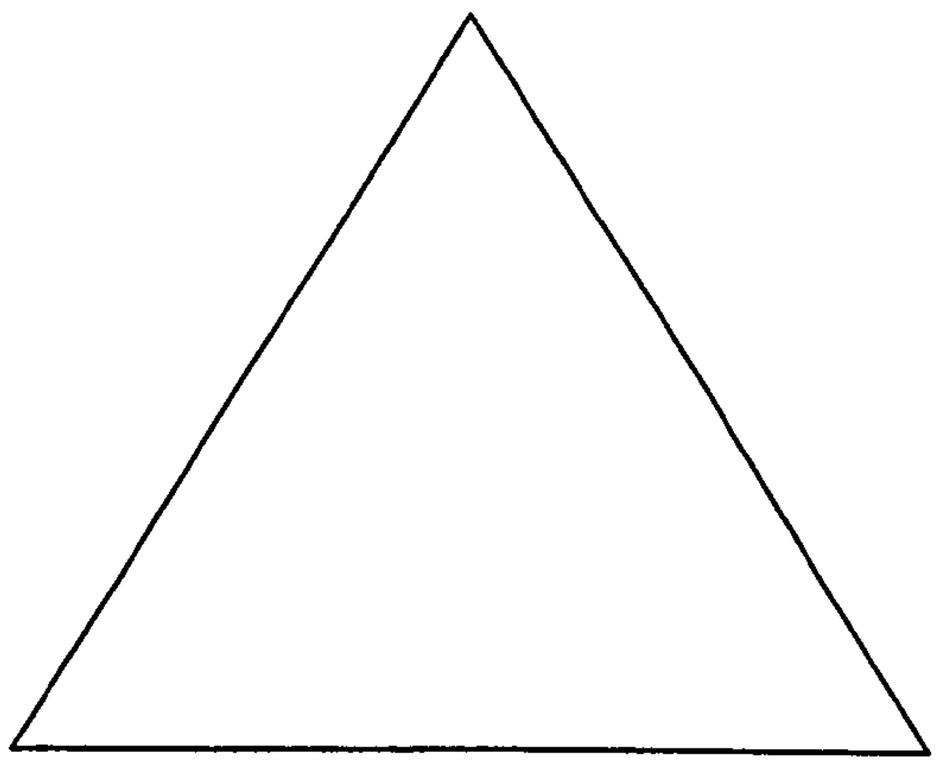
.....

.....

.....

2. Project management theory categorises project objectives under three headings, often presenting these at the corners of a triangle. Name the three categories below:

(a) .....



(b) ..... (c) .....

3. Belbin discovered that the best teams were those in which the psychological balance was optimised. Identify FOUR of Belbin's profiles

(a) .....

(b) .....

(c) .....

(d) .....

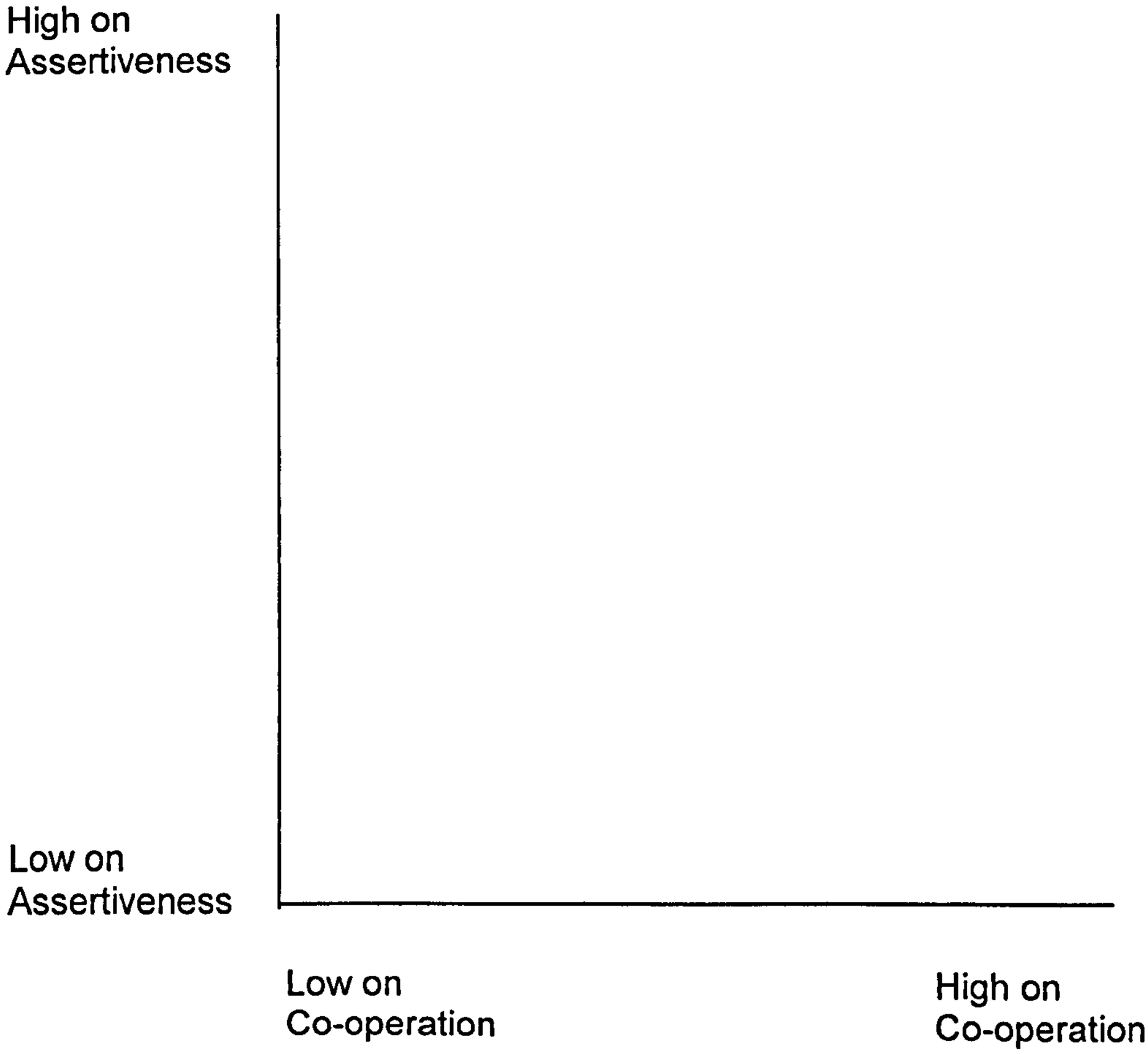
4. Conventional belief identifies two independent dimensions to a manager's leadership style or behaviour. What are they?

(a) .....

(b) .....

5. Plot the following styles of negotiation on the graph below:

A Winning – Losing
B Accommodating
C Avoiding
D Compromising
E Collaborating



6. Identify three express obligations on the project manager under the Association for Project management Terms and Conditions of Appointment:

(a) .....

.....

(b) .....

.....

(c) .....

.....

7. MacPherson advocated a two stage briefing process. What are the characteristics of each stage:

First stage:.....

.....

Second stage:.....

.....

8. A company director has a choice of three strategies for countering the effects of the millennium bug and gaining a competitive advantage in the market:

Strategy A	Initial Cost	£120,000
	Profit	£300,000 (80% Probability)
	Loss	£150,000 (20% Probability)
Strategy B	Initial Cost	£40,000
	Profit	£500,000 (50% Probability)
	Loss	£200,000 (50% Probability)
Strategy C	Initial Cost	Nil
	Profit	£800,000 (30% Probability)
	Loss	£300,000 (70% Probability)

(a) Which strategy provides the maximum Expected Monetary Value?

Please tick the appropriate box ☐ A ☐ B ☐ C

(b) What is the Expected Monetary Value for the chosen strategy in Question 8 (a)?

.....

9. What is the principal disadvantage associated with the application of sensitivity analysis in risk management?

.....

10. Having identified and quantified the risks involved in a project, what types of response are available?

(a) .....

(b) .....

(c) .....

(d) .....

(e) .....

11. Value may be expressed as:

$$\text{Value} = \frac{\text{Function (worth)}}{\text{Cost}}$$

Explain the meaning of this formula

.....

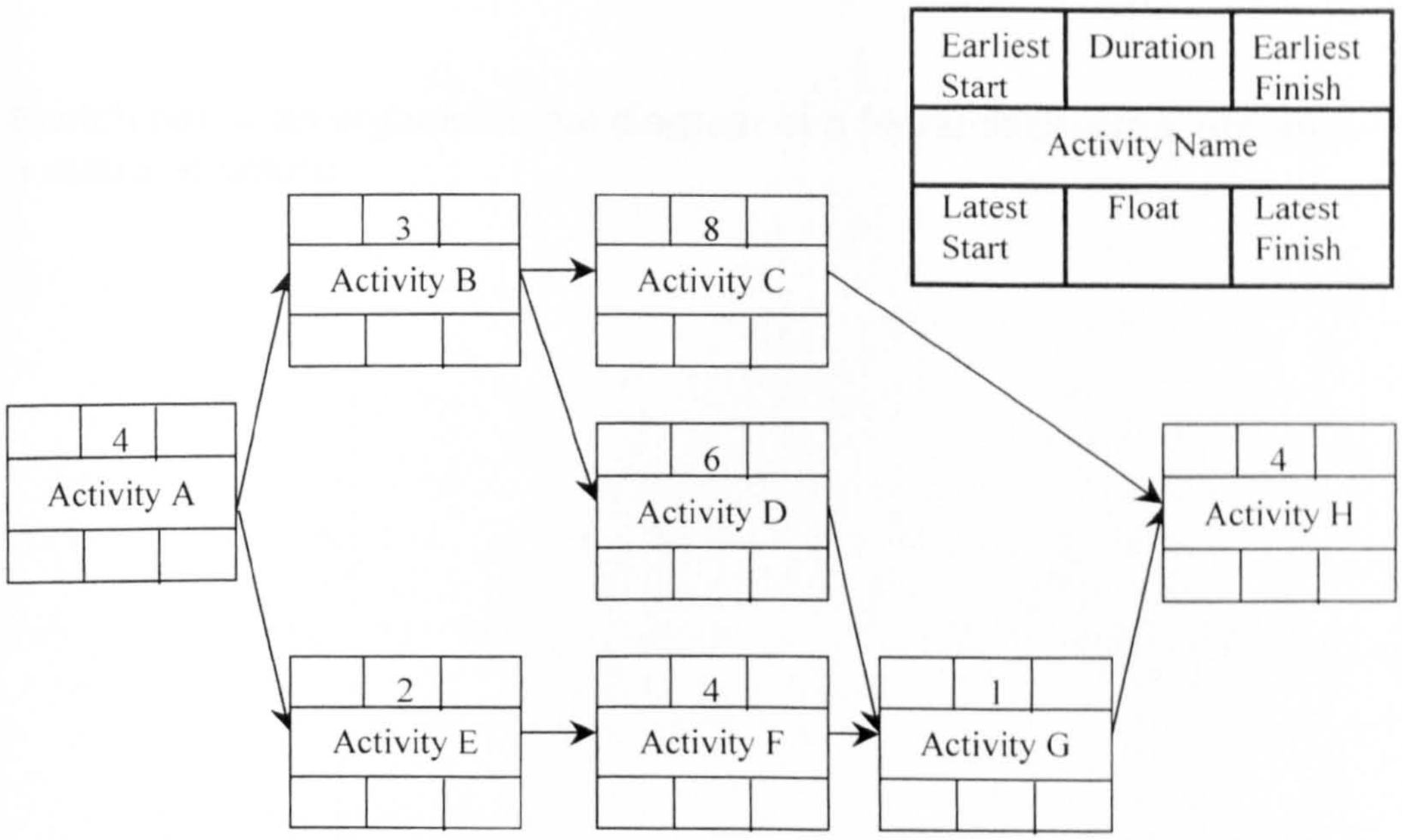
.....

12. What is the difference between Value Management and Value Engineering?

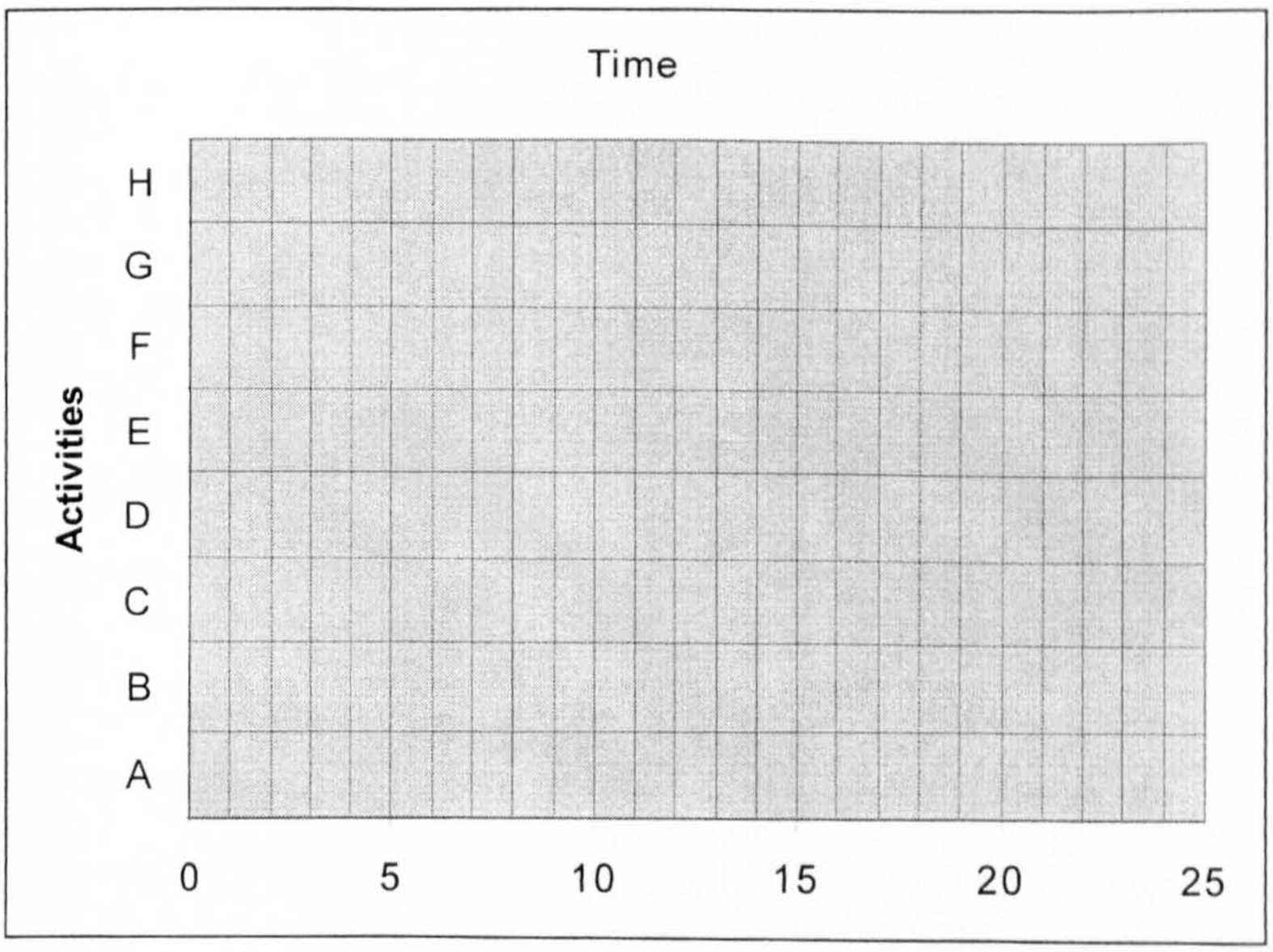
.....

.....

13. Calculate the forward and backward pass and insert the earliest and latest start and earliest and latest finish dates on the following network:



14. Draw a bar chart to represent the sequence of activities shown in question 13.



15. What is the meaning of float?

.....

16. Sketch below an organisational diagram of a hierarchical structure and a matrix structure.

LEEDS METROPOLITAN UNIVERSITY

"Project Management" Module Evaluation
Post-test

Student ID: ..... Mode: FT PT DL CAL delete as necessary

To be completed at the end of the module and returned to module tutor

The development of the postgraduate Project Management module has been part funded by the University's "Open Flexible Learning Project: Phase 3" (OFL3). The project seeks to determine the effectiveness of the support systems in the University. Independent research is also being undertaken to evaluate the effectiveness of learning resources delivered in a variety of different modes i.e. part-time, open and distributed multimedia.

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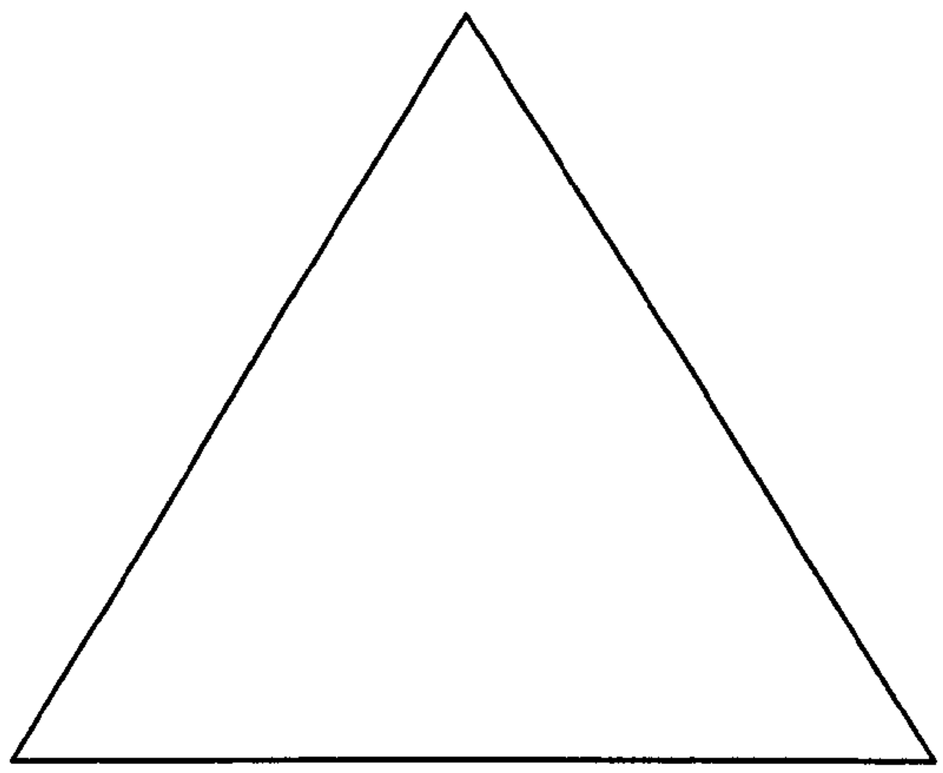


(b) ..... (c) .....

3. Kolb (1984) proposed a four stage model in the learning process. Identify each stage:

(a) .....

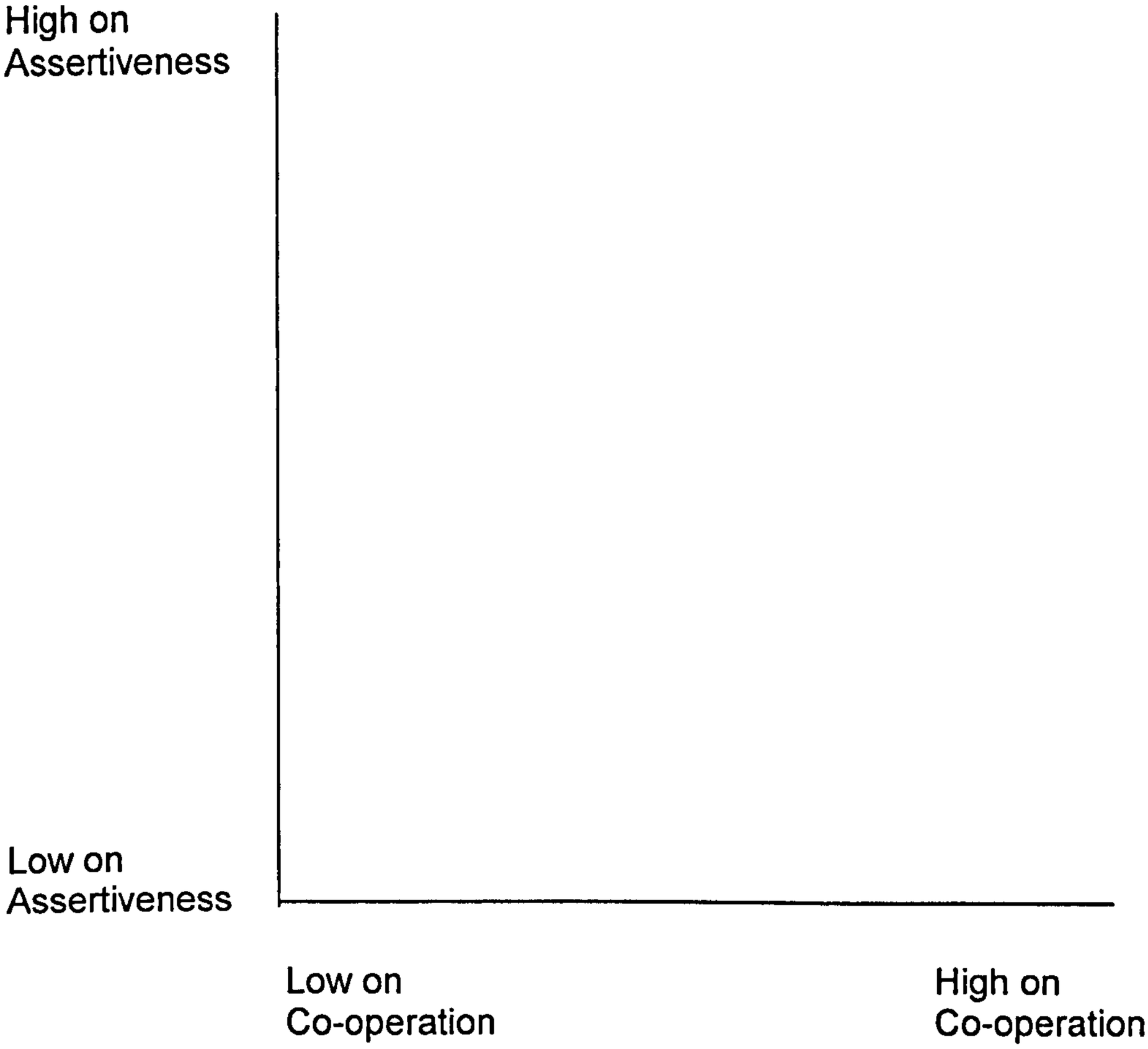
(b) .....

(c) .....

(d) .....

4. Plot the following styles of negotiation on the graph below:

A Winning – Losing
B Accommodating
C Avoiding
D Compromising
E Collaborating



5. It is argued that by increasing the size of one "pane" in the "Johari" window it is possible to improve our interpersonal skills.

(a) Which pane should be increased?

.....

(b) How does this improve interpersonal skills?

.....

6. Identify three express obligations on the project manager under the Association for Project management Terms and Conditions of Appointment:

(a) .....

.....

(b) .....

.....

(c) .....

.....

7. MacPherson advocated a two stage briefing process. What are the characteristics of each stage:

First stage:.....

.....

Second stage:.....

.....

8. There are four common approaches to risk, cited by Flanagan and Norman, that highlight the inadequacy of the construction industry to cope with risk. What are they?

(a) .....

(b) .....

(c) .....

(d) .....

9. A company director has a choice of three strategies for countering the effects of the millennium bug and gaining a competitive advantage in the market:

Strategy A	Initial Cost	£ 90,000
	Profit	£400,000 (70% Probability)
	Loss	£150,000 (30% Probability)
Strategy B	Initial Cost	£30,000
	Profit	£500,000 (50% Probability)
	Loss	£200,000 (50% Probability)
Strategy C	Initial Cost	Nil
	Profit	£800,000 (30% Probability)
	Loss	£300,000 (70% Probability)

Which strategy provides the maximum Expected Monetary Value?

Please tick the appropriate box ☐ A ☐ B ☐ C

10. What is the Expected Monetary Value for the chosen strategy in Question 9?

.....

11. What is the principal disadvantage associated with the application of sensitivity analysis in risk management?

(a) .....

How can this be overcome?

(b) .....

12. The functions listed are the result of a function brainstorming session for a university library project. Construct a FAST diagram below.

House resources

Enable copying

House periodicals

Manage holdings

Facilitate study activities

Disseminate information

House audio/visual material

Control access

House books

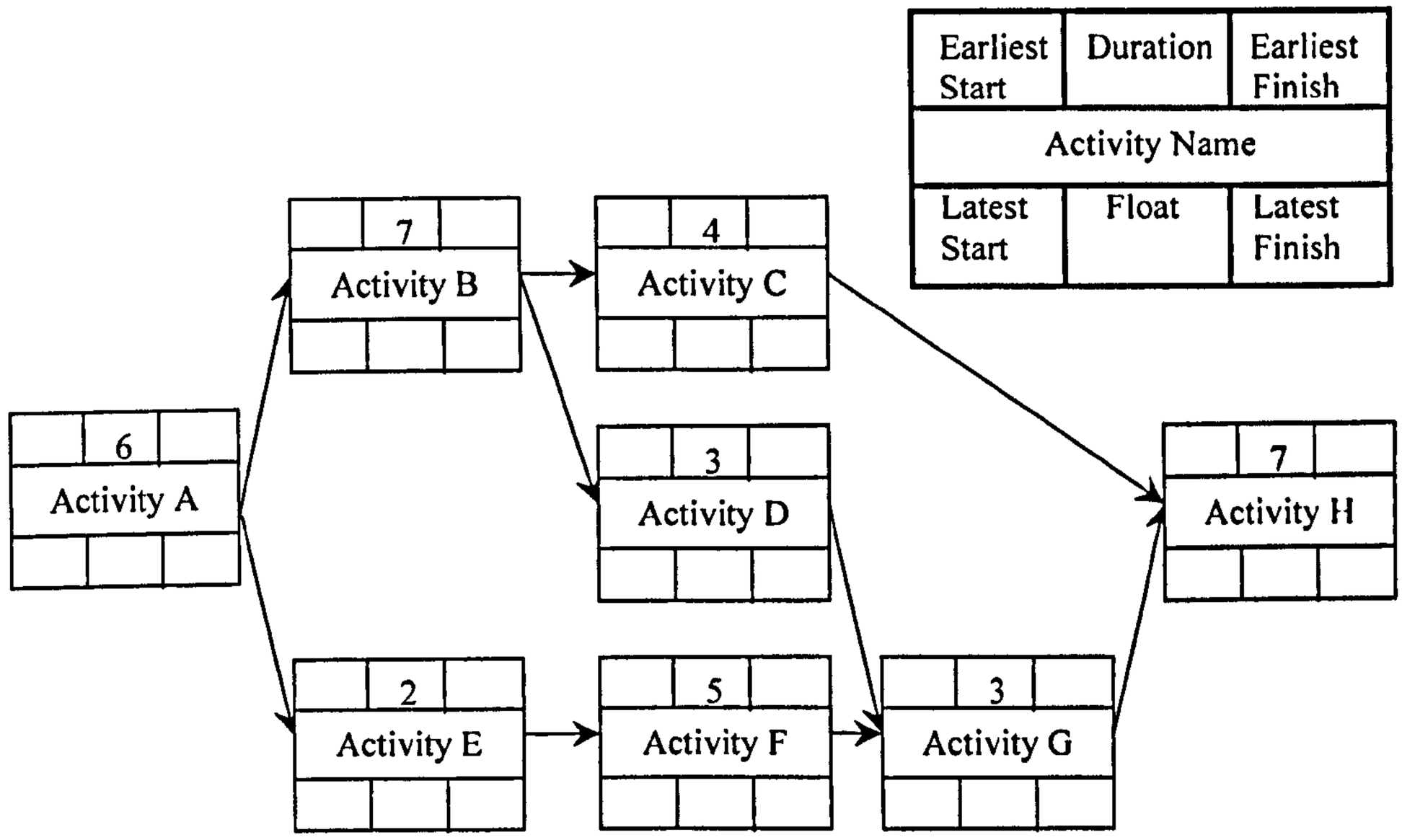
Enable retrieval

House micro text

Accommodate students

Catalogue materials

13. Calculate the forward and backward pass and insert the earliest and latest start and earliest and latest finish dates on the following network:



14. What does "critical path" mean?

.....

.....

15. Sketch below an organisational diagram of a hierarchical structure and a matrix structure.

Module Assessment—part1

Presentation assignment

This part of the module assessment is worth 40%.

You are required to submit a videotaped presentation made by yourself.

Alternatively, you may wish to be videoed in the University TV studio at Calverley Street. If so, please contact Robert Ellis or Gerard Wood to arrange a booking.

The subject of the presentation will be self selected from the list of debate motions. Please confirm with either module tutor which motion you wish to choose.

Your presentation should speak in favour of the selected motion. However, you should in your consideration identify likely arguments against the motion and proceed to respond to these arguments. It is therefore important to structure your presentation in a coherent manner. The following framework is suggested, but not prescribed:

Introduction

- Identify yourself.
- Recite the motion of which you are speaking in favour.
- Briefly introduce the subject matter and explain / define the terms used.
- Outline the structure of your presentation.

Main Body

- Making reference to respected authorities in the field, other research, or your own validated experience present a cogent and substantiated argument in favour of the motion.
- In your consideration you should identify likely opposing arguments and attempt to persuasively discount them. This may be done singly towards the end of your main consideration or intermittently throughout.

Conclusion

- Summarise the key aspects / issues.
- Draw a suitable conclusion which stems from the evidence consider in the main body. If appropriate, make a recommendation(s).

Presentation - rules

- The presentation is to be submitted on a standard grade stereo video cassette, made by a recognised manufacturer.
- Your whole body must be in view of the camera (i.e. not just head and shoulders) though you may wish to stand / sit behind a table / desk.
- You may refer to notes, though reading verbatim from a pre-prepared script is wholly inadvisable.
- DO NOT EDIT THE TAPE - you must submit a single continuous presentation.
- The use of visual aids are optional (but please note the above rule and tip number 6).

presentation tips

1. Present a professional image - imagine you are giving a presentation to an important client via video conferencing.
2. Address the camera lens.
3. Ensure that your voice is clear and audible.
4. The background should be plain - check the lighting to avoid glare, don't stand in front of a window, avoid jaunty camera angles.
5. This is not an exercise in photography, film or television. Do not bother with moving the camera, dolly shots, zooming in or out, or music. Simply set the camera up so as to enable a professional image to be projected (as point 1).
6. Be careful in your use of visual aids. Make sure they are comprehensible. If they do not positively enhance your presentation, leave them out.

Presentation - assessment criteria

The presentation will be assessed by 2 tutors independently. They will then compare notes and arrive at an agreed mark. Assessment will be made strictly in accordance with the criteria listed below.

Structure and Content
format, sequence, logical flow of consideration, clarity of argument, attention to key issues (40%)

Research & source material
depth of understanding, number of credible citations, breadth and relevance of sources used (30%)

Presentation
voice, pace, variety, liveliness, clarity of expression, fluency (30%)

Presentation - references

A Gower training video 'Public speaking with confidence' is available in the library (reference only).

debate motions & presentation topics

No.1

The primary task of the project manager is to establish a meaningful definition of the project's quality objectives

No.2

The project manager is unable to influence the motivation of individuals within the project team

No.3

The most effective project managers are those with a knowledge of the industry within which the project is founded

No.4

The principal aim of the project manager is to produce a good quality product for the client

No.5

The conception phase is the most important stage within the project life cycle

No.6

Expertise in the use of project management planning & control techniques is more important to the project manager than are people management skills

No.7

A project oriented matrix organisation creates more problems than it solves

Construction specific debate and presentation topics

No.8

The project manager assumes authority for the design and construction process but carries no legal liability

No.9

The construction phase is the most important activity within the development process

No.10

Project management has a significant role to play in achieving the targets set by Egan

Module Assessment—part2

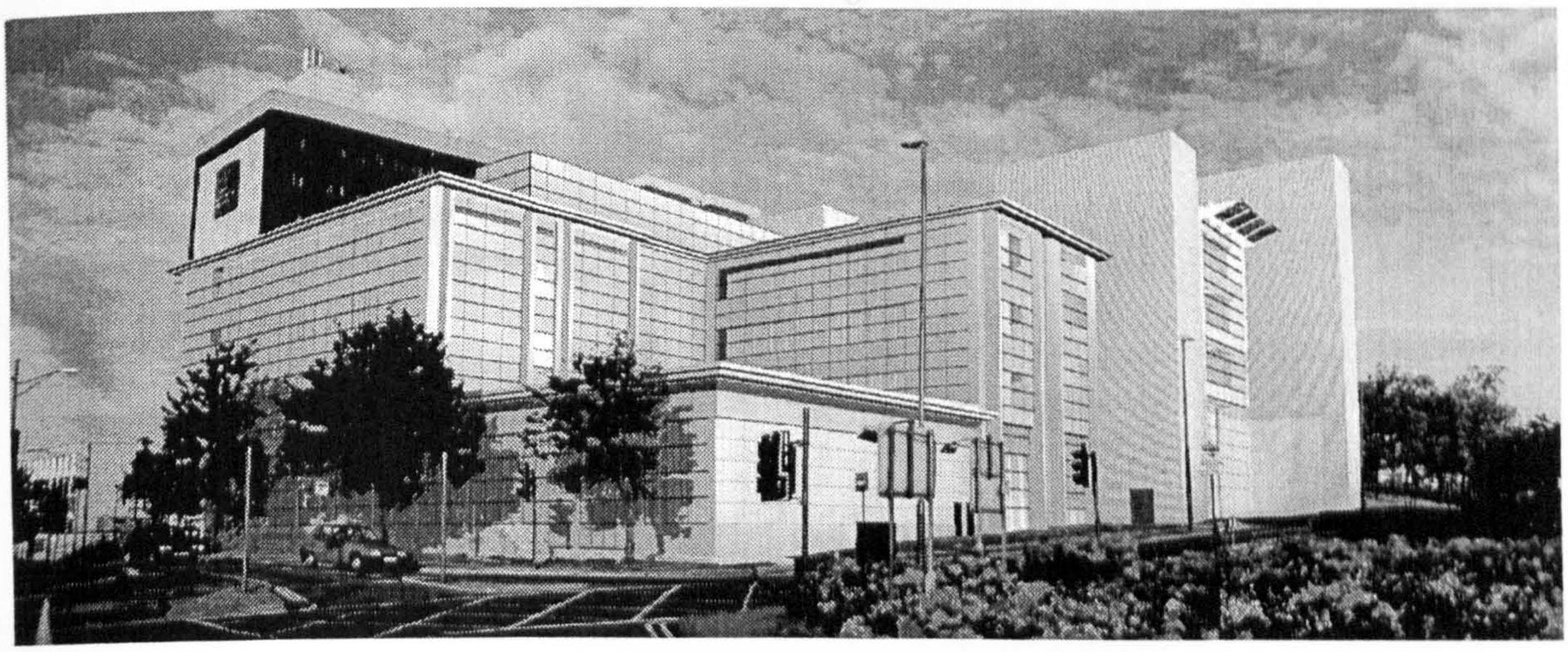
assignment: 24hr learning centre

Introduction

The assignment presents a realistic project oriented scenario that requires the application of specific project management techniques in the formulation of an appropriate solution.

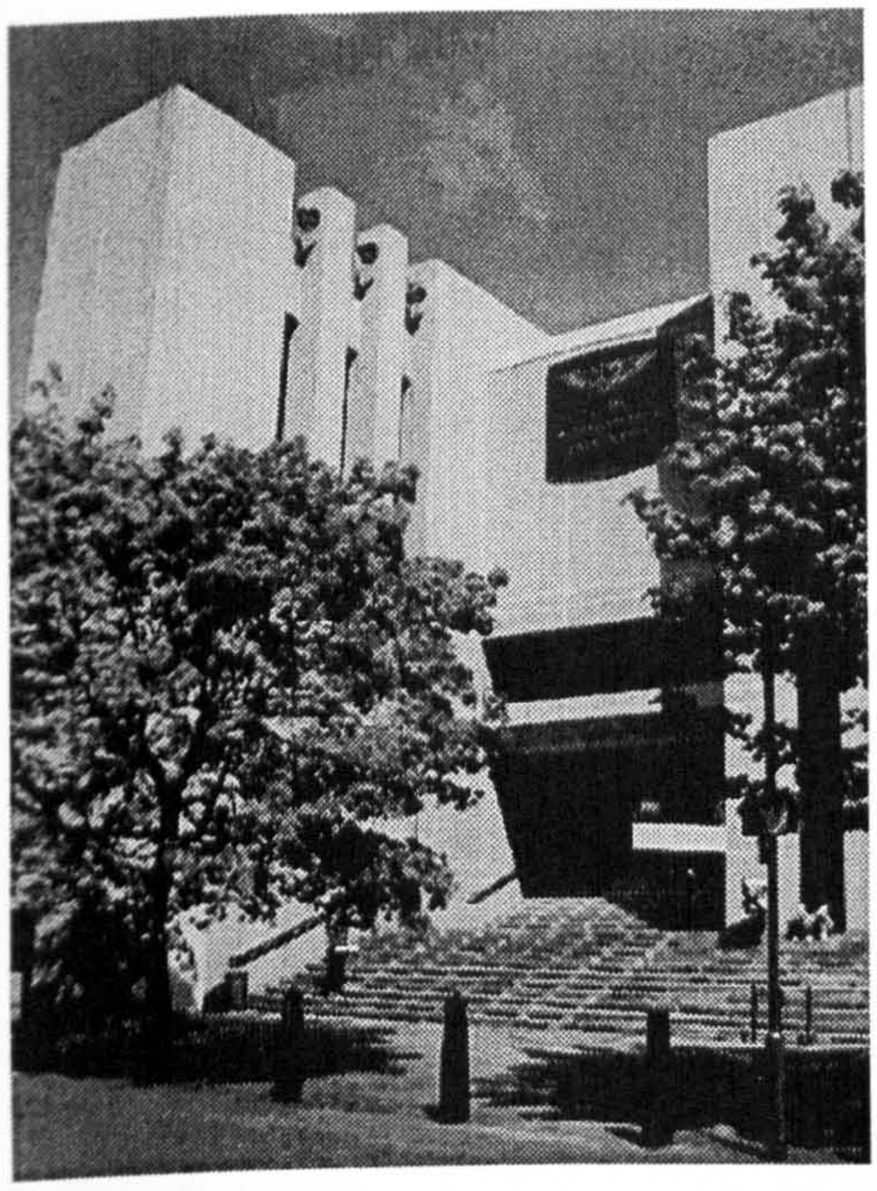
The project

A new learning centre is to be constructed on the Calverley Street campus at Leeds Metropolitan University. The learning centre will provide all students currently using the library facilities at Calverley Street and the nearby Brunswick Building with learning support services e.g. library, study space and computing facilities.



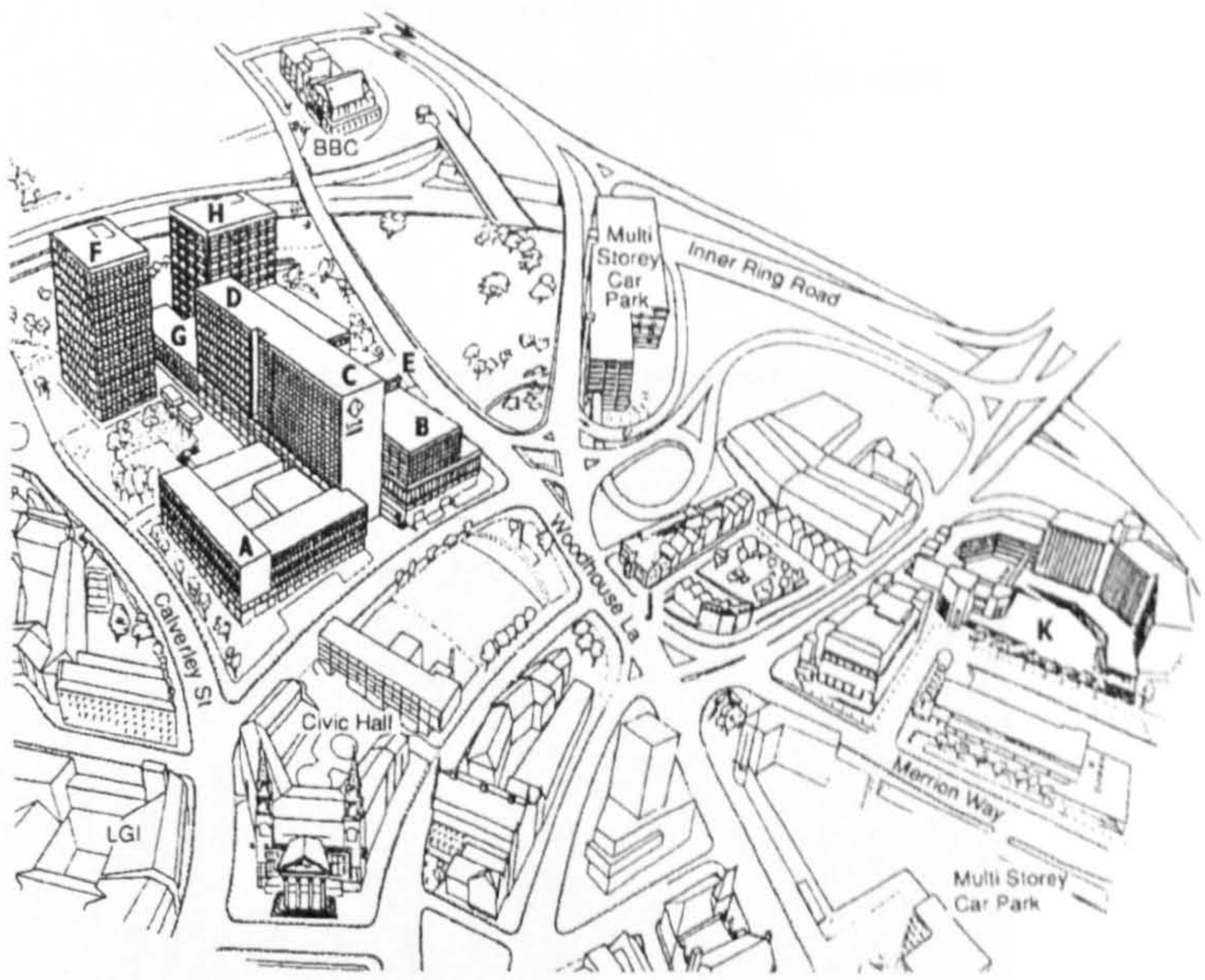
elevation from Woodhouse Lane

The library currently situated in Brunswick Building, a satellite location for the Faculty of Health and the Environment, is to relocate to Calverley Street.



Brunswick Building

Likewise, the existing library on Calverley Street campus is also to move into the new premises.



Key

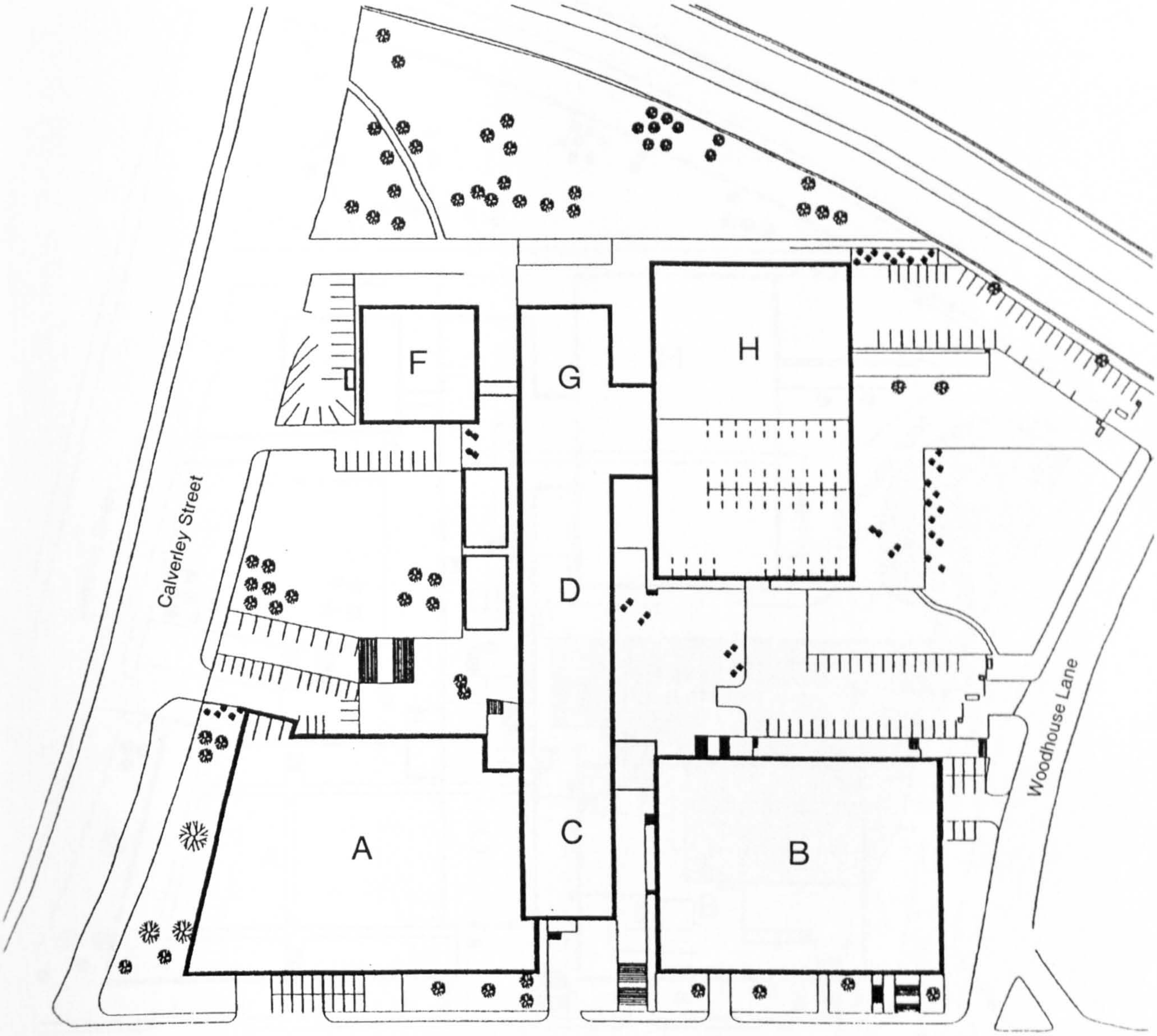
A **A building**
B **B building** partly developed as part of new Learning Centre
C **C Building** Current Learning Centre (6th floor) and Library (4th floor)
D **D Building**
E **Site of new Learning Centre**
F **F Building**
G **G Building**
H **H Building**
J **Queens Square**
K **Brunswick Building**

On completion of the new learning centre, the Faculty is to relocate in the void vacated by the existing Calverley Street library. This will necessitate remodelling of the existing building.

The Director of Estates has imposed the following Work Breakdown Structure on the project:

- *Construction of the new 24 hour learning centre;*
- *Relocation of the existing Calverley Street and Brunswick Building library facilities;*
- *Remodelling of the void left by the Calverley Street library;*
- *Relocation of the Faculty of Health and the Environment; and*
- *Disposal of Brunswick Building.*

24 hour learning centre main entrance



Plan of Calverley Street Campus

Plan of Learning Centre Development

Client organisation

The client organisation and their requisite responsibilities are as follows:

- *Executive Board:*
  - *Overall strategy*
  - *Approval of expenditure*
- *Estates Division:*
  - *Procurement of new facilities*
  - *Improvement of existing facilities*
  - *Management of the relocation*
  - *Appointment of consultants and contractors*
- *Faculty of Health and the Environment:*
  - *Maintaining academic provision*
  - *Consultation with staff*
  - *Consultation with students*
- *Learning and Information Services*
  - *Maintaining learning centre facilities*
  - *Consultation with learning centre staff*

Faculty of Health and the Environment

The activities of the Faculty can be summarised as follows:

- *Delivery of undergraduate and postgraduate teaching;*
- *Provision of in-company and continuing professional development short courses (i.e. Spring/Summer programmes);*
- *Research and consultancy;*
- *Administration and management of the academic portfolio.*

Proposals

The new learning centre is to be completed in Autumn 2002 and it is preferable that the Faculty be relocated during the "summer" vacation of the following year. It is envisaged that the overall area of the existing Calverley Street library will accommodate the needs of the Faculty.

Please note the following parameters:

- *Enabling works cannot be included with other works contracts;*
- *Contracts for fittings and IT are negotiated directly by the university;*
- *Relocation of the Calverley Street and Brunswick Building libraries must be implemented during the summer vacation;*
- *Existing academic departments must be relocated during the following summer vacation; and*
- *Design and budget to be sanctioned by Executive Board during November.*

hint

It is anticipated that each aspect of the project could not be tackled "end-on" and that there would be overlapping of various activities related to the two aspects.

Tasks

There are two principal aspects to the assignment:

- *Re-location of the existing Calverley Street and Brunswick Building library facilities;*
- *Relocation of the Faculty of Health and Environment*

Disposal of the Brunswick Building is beyond the scope of this project.

You are to assume that you have been appointed as the project manager and that you are required to:

- *Prepare a network and accompanying bar chart for the relocations; and*
- *Draft a functional linear responsibility chart.*

Guidance

Generally

Do not focus on the project as a series of construction operations. To do so would involve making many assumptions that detract from the "real" nature of the project. It would result in the task being that of a construction planner rather than a project manager. The tasks should consider activities from inception to handover of the project.

Correct application of network analysis technique is important and must comply with the parameters set. You are expected to impose both pure logic and preferential logic to make the plan workable. Importantly, the network should be easy to understand and follow - this is a question of clarity in presentation and appropriate annotation. You may include explanatory notes to assist in the breakdown of activities but a "justification" for the project is not required.

Project durations should be appropriate/realistic but there is obviously a margin for judgement. Durations that are excessive or deliberately manipulated will be penalised.

So often a tutor is asked "How large should the network be?" Much will depend upon the solution put forward, but it would be reasonable to suggest that the network could be contained on an A3 sheet of paper.

Computer aided project management software may be used. However, it will attract no additional marks to those detailed under "Assessment criteria".

Assume that the project start-date is the same as the start-date for this module.

Resources are not to be assigned to the activities on the network.

Assessment criteria

Breakdown of activities *20%*

- *Suitability of packages in terms of size and criticality*
- *Activities in accordance with suggested life cycle*
- *Recognition of approvals and consultations*
- *Durations of activities*

Network *40%*

- *Logic, sequence and compliance with parameters*
- *Clarity of network*

Gantt chart *20%*

- *Clarity and annotation*
- *Accuracy relative to network*
- *Relationship between Gantt chart and network*

Functional Linear Responsibility Chart *20%*

- *Identification of project stakeholders*
- *Appropriate assignment of responsibilities*
- *Clarity and appropriate legend*

Outcomes

- *To breakdown a project and devise a logical sequence of activities;*
- *To apply the critical path method in a realistic context; and*
- *To critically analyse the roles of the project team and translate these into a communications plan.*

LEEDS METROPOLITAN UNIVERSITY

"Project Management" Module Evaluation
Learning Style Profile

Name: .....

The development of the postgraduate Project Management module has been part funded by the University's "Open Flexible Learning Project: Phase 3" (OFL3). The project seeks to determine the effectiveness of the support systems in the University. Independent research is also being undertaken to evaluate the effectiveness of learning resources delivered in a variety of different modes i.e. part-time, open and distributed multimedia.

In order to satisfy the University's requirements and to provide empirical data for the separate research study, a comparative longitudinal evaluation is to be conducted. Academic staff have undertaken a formative evaluation of the design and methods adopted in the module and we are seeking your support in the evaluation of the training you receive.

The objectives of this aspect of the evaluation are:

- To determine the participants' impressions about their education i.e. Reaction;
- To measure the learning gain achieved by the educational programme i.e. Learning; and
- To assess the extent to which learning has been generalised to the work situation i.e. Behaviour

The methods used to conduct the evaluation are:

- Focus groups;
- "Interest and Involvement" graphs
- Pre and post-testing; and
- Self-efficacy rating

The variety of evaluation methods used should generate comparative data that addresses specific questions and detects unexpected results through open-ended questions.

These methods are designed to evaluate the module and not to evaluate the individual students. The results from the tests do not form a part of the formal assessment for this module.

Learning Style Profile

This questionnaire is designed to find out your preferred learning style(s). Over the years you have probably developed learning 'habits' that help you benefit more from some experiences than others. Since you are probably unaware of this, this questionnaire will help you pinpoint your learning preferences so that you are in a better position to select learning experiences that suit your style (Honey and Mumford, 1982).

Method

There is no time limit to this questionnaire. It will probably take you 10-15 minutes. The accuracy of the results depends upon how honest you can be. There are no right or wrong answers. If you agree more than you disagree with a statement put a tick by it ☑. If you disagree more than you agree put a cross by it ☒. Be sure to mark each item with a tick or cross.

☐ 1. I have strong beliefs about what is right and wrong, good and bad.
☐ 2. I often 'throw caution to the winds'.
☐ 3. I tend to solve problems using a step-by-step approach, avoiding any 'flights-of-fancy'.
☐ 4. I believe that formal procedures and policies cramp people's style.
☐ 5. I have a reputation for having a no-nonsense, 'call a spade a spade' style.
☐ 6. I often find that actions based on 'gut feel' are as sound as those based on careful thought and analysis.
☐ 7. I like to do the sort of work where I have time to 'leave no stone unturned'
☐ 8. I regularly question people about their basic assumptions.
☐ 9. What matters most is whether something works in practice.
☐ 10. I actively seek out new experiences.
☐ 11. When I hear about a new idea or approach I immediately start working out how to apply it in practice.
☐ l2. I am keen on self discipline such as watching my diet, taking regular exercise, sticking to a fixed routine etc.
☐ 13. I take pride in doing a thorough job.
☐ 14. I get on best with logical, analytical people and less well with spontaneous, 'irrational' people.
☐ 15. I take care over the interpretation of data available to me and avoid jumping to conclusions.
☐ 16. I like to reach a decision carefully after weighing up many alternatives.
☐ 17. I'm attracted more to novel, unusual ideas than to practical ones.

☐ 18. I don't like 'loose-ends' and prefer to fit things into a coherent pattern.
☐ 19. I accept and stick to laid down procedures and policies so long as I regard them as an efficient way of getting the job done.
☐ 20. I like to relate my actions to a general principle.
☐ 21. In discussions I like to get straight to the point.
☐ 22. I tend to have distant, rather than formal relationships with people at work.
☐ 23. I thrive on the challenge of tackling something new and different.
☐ 24. I enjoy fun-loving, spontaneous people.
☐ 25. I pay meticulous attention to detail before coming to a conclusion.
☐ 26. I find it difficult to come up with wild, off-the-top-of-the-head ideas.
☐ 27. I don't believe in wasting time by 'beating around the bush'.
☐ 28. I am careful not to jump to conclusions too quickly.
☐ 29. I prefer to have as may sources of information as possible - the more data to mull over the better.
☐ 30. Flippant people who don't take things seriously enough usually irritate me.
☐ 31. I listen to other people's point of view before putting my own forward.
☐ 32. I tend to be open about how I'm feeling.
☐ 33. In discussions I enjoy watching the manoeuvrings of the other participants.
☐ 34. I prefer to respond to events on a spontaneous, flexible basis rather than plan things out in advance.
☐ 35. I tend to be attracted to techniques such as network analysis, flow charts, branching programmes, contingency planning, etc.
☐ 36. It worries me if I rush out a piece of work to meet a tight deadline.
☐ 37. I tend to judge people's ideas on their practical merits.
☐ 38. Quiet, thoughtful people tend to make me feel uneasy.
☐ 39. I often get irritated by people who want to rush headlong into things.
☐ 40. It is more important to enjoy the present moment than to think about the past or future.
☐ 41. I think that decisions based on a thorough analysis of all the information are sounder than those based on intuition.
☐ 42. I tend to be a perfectionist.
☐ 43. In discussions I usually pitch in with lots of off-the-top-of-the-head ideas.
☐ 44. In meetings I put forward practical realistic ideas.
☐ 45. More often than not, rules are there to be broken.
☐ 46. I prefer to stand back from a situation and consider all the perspectives.
☐ 47. I can often see inconsistencies and weaknesses in other people's arguments.
☐ 48. On balance I talk more than I listen.
☐ 49. I can often see better, more practical ways to get things done.
☐ 50. I think written reports should be short, punchy and to the point.
☐ 51. I believe that rational, logical thinking should win the day.

- ☐ 52. I tend to discuss specific things with people rather than engaging in 'small talk'.
- ☐ 53. I like people who have both feet firmly on the ground.
- ☐ 54. In discussions I get impatient with irrelevancies and 'red herrings'.
- ☐ 55. If I have a report to write I tend to produce lots of drafts before settling on the final version.
- ☐ 56. I am keen to try things out to see if they work in practice.
- ☐ 57. I am keen to reach answers via a logical approach.
- ☐ 58. I enjoy being the one that talks a lot.
- ☐ 59. In discussions I often find I am realistic, keeping people to the point and avoiding 'cloud nine' speculations.
- ☐ 60. I like to ponder many alternatives before making up my mind.
- ☐ 61. In discussions with people I often find I am the most dispassionate and objective.
- ☐ 62. In discussions I'm more likely to adopt a 'low profile' than to take the lead and do most of the talking.
- ☐ 63. I like to be able to relate current actions to a longer term bigger picture.
- ☐ 64. When things go wrong I am happy to shrug it off and 'put it down to experience'.
- ☐ 65. I tend to reject wild, off-the-top-of-the-head ideas as being impractical.
- ☐ 66. It's best to 'look before you leap'.
- ☐ 67. On balance I do the listening rather than the talking.
- ☐ 68. I tend to be tough on people who find it difficult to adopt a logical approach.
- ☐ 69. Most times I believe the end justifies the means.
- ☐ 70. I don't mind hurting people's feelings so long as the job gets done.
- ☐ 71. I find the formality of having specific objectives and plans stifling.
- ☐ 72. I'm usually the 'life and soul' of the party.
- ☐ 73. I do whatever is expedient to get the job done.
- ☐ 74. I quickly get bored with methodical, detailed work.
- ☐ 75. I am keen on exploring the basic assumptions, principles and theories underpinning things and events.
- ☐ 76. I'm always interested to find out what other people think.
- ☐ 77. I like meetings to be run on methodical lines, sticking to laid down agenda, etc..
- ☐ 78. I steer clear of subjective or ambiguous topics.
- ☐ 79. I enjoy the drama and excitement of a crisis situation.
- ☐ 80. People often find me insensitive to their feelings.

Scoring and interpreting the Learning Style Questionnaire (LSQ)

The LSQ is scored by awarding one point for each ticked item. There are no points for crossed items.

Simply indicate on the lists below which items were ticked.

2	7	1	5
4	13	3	9
6	15	8	11
10	16	12	19
17	25	14	21
23	28	18	27
24	29	20	35
32	31	22	37
34	33	26	44
38	36	30	49
40	39	42	50
43	41	47	53
45	46	51	54
48	52	57	56
58	55	61	59
64	60	63	65
71	62	68	69
72	66	75	70
74	67	77	73
79	76	78	80
Totals ___	___	___	___
Activist	*Reflector*	*Theorist*	*Pragmatist*

LSQ Profile

Plot the scores above onto the LSQ profile below based on the general norms for managerial/professional people

Activist	Reflector	Theorist	Pragmatist	
20 19	20	20	20	
18		19	19	
17	19			
16		18		Very strong preference
15			18	
14		17		
13	18	16	17	
12	17	15	16	Strong preference
	16			
11	15	14	15	
10	14	13	14	
9	13	12	13	Moderate preference
8				
7	12	11	12	
6	11	10	11	
5	10	9	10	Low preference
4	9	8	9	
3	8	7	8	
	7		7	
	6	6	6	
2	5	5	5	Very low preference
	4	4	4	
1	3	3	3	
	2	2	2	
	1	1	1	
0	0	0	0	

Activist
Activists involve themselves fully without bias in new experiences. They enjoy the here and now and are happy to be dominated by immediate experiences. They are open-minded, not sceptical, and this tends to make them enthusiastic about anything new. They tend to throw caution to the wind. Their days are filled with activity. They revel in short term fire fighting. They often tackle problems by brainstorming. They tend to thrive on the challenge of new experiences but are bored with implementation and longer term consolidation. They are gregarious people constantly involving themselves with others but in doing so they hog the limelight. They are the life and soul of the party and seek to centre all activities around themselves.

Reflector
Reflectors like to stand back to ponder experiences and observe them from many different perspectives. They collect data, both first hand and from others, and prefer to chew it over thoroughly before coming to any conclusions. The thorough collection and analysis of data about experiences and events is what counts so they tend to postpone reaching definitive conclusions for as long as possible. Their philosophy is to be cautious, to leave no stone unturned. 'Look before you leap'; 'Sleep on it'. They prefer to take a back seat in meetings and discussions. They enjoy observing other people in action. They listen to others and get the drift of the discussion before making their own points. They tend to adopt a low profile and have a slightly distant, tolerant, unruffled air about them. When they act it is part of a wide picture which includes the past as well as the present and others' observations as well as their own.

Theorist
Theorists adapt and integrate observations into complex but logically sound theories. They think problems through in a vertical, step by step logical way. They assimilate disparate facts in coherent theories. They tend to be perfectionists who won't rest easy until things are tidy and fit into their rational scheme. They like to analyse and synthesise. They are keen on basic assumptions, principles, models, theories and systems thinking. Their philosophy prizes rationality and logic. Questions they frequently ask are 'Does it make sense?' 'How does this fit with that?'. They tend to be detached, analytical and dedicated to objectivity rather than anything subjective or ambiguous.

Pragmatist
Pragmatists are keen on trying out ideas, theories and techniques to see if they work in practice. They positively search out new ideas and take the first opportunity to experiment with applications. They are the sort of people who return from management courses brimming with new ideas that they want to try out in practice. They like to get on with things and act quickly and confidently on ideas that attract them. They don't like 'beating around the bush' and tend to be impatient with ruminating and open-ended discussions. They are essentially practical, down to earth people who like making practical decisions and solving problems. They respond to problems and opportunities 'as a challenge'.

School of the Built Environment

Student Module Evaluation Form **Session 2000/01**

Student ID: ..... *Module:* .....

Mode: FT PT DL CAL delete as necessary *Module Leader:* .....

No. of Students..... *Today's Date:* .....

Three things you feel went well in the module:

1.....

.....

2.....

.....

3.....

.....

Three things you feel could have been better in the module:

1.....

.....

2.....

.....

3.....

.....

Any Other Comments:

.....

.....

.....

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Interest and Involvement

Student ID: ..... Mode: FT PT DL CAL delete as necessary

To be completed at the end of each topic in the study guide and returned to the module tutor on completion of the module.

As the title suggests this instrument provides a method of gathering information from learners about their feelings during their training.

You are asked to plot on a graph your level of interest and involvement throughout your training. The information that is collected will be used to support findings from the focus groups at the end of the module.

The instrument is based on a design from Bartram S. and Gibson B (1999) Evaluating Training, Gower

Thank you for completing the questionnaire. Your responses will provide valuable data that will inform the future development of postgraduate project management provision.

Robert Ellis
Principal Lecturer
Leeds Metropolitan University

As you progress through the module, use the graph below to plot your level of interest by marking with a cross (x). At the end of the module join the crosses with a line to create a profile of how interested you have been in your learning.

HIGH

LOW

Project Perspectives Definitions/games	Project Perspectives Organisation and structure	Project Perspectives Briefing	Tools and techniques Planning/CPM	Tools and techniques Value Management	Tools and techniques Risk Management	Interpersonal skills Communication	Interpersonal skills Team working	Case studies	Video Presentation	Assignment

Please add comments to help explain your choices:

Ref	Semester	Scheme	Age	Gender	LSP	Instrument	Pre-test	Post-test	Pre-self	Post-self	Part 1	Part 2	Total
1	1/00	CLA	34	F	R	C	26	39	121	180	65	37	48
2	1/00	MBA	41	M	P	C	17	48	162	208	53	55	54
3	1/00	FM	27	M	P	C	27	44	197	241	55	53	54
5	1/00	MBA	29	F	P	C	15	52	146	206	60	64	62
6	1/00	PM	35	M	R	C	2	41	171	210	52	50	51
7	1/00	MBA	31	F	P	C	41	41	147	244	63	55	58
8	1/00	CLA	32	M	A	C	22	48	170	222	60	52	55
9	1/00	MBA	50	M	R	C	32	52	204	245	58	63	61
10	1/00	PM	36	F	T	C	12	61	202	217	58	70	65
11	1/00	FM	30	F	P	C	39	34	219	235	68	59	63
12	1/00	FM	40	M	T	C	17	32	95	151	63	60	61
13	1/00	MBA	25	M	R	C	5	56	102	181	58	62	60
14	1/00	PM	27	F	R	C	39	58	182	224	58	67	63
15	1/00	PM	27	M	A	C	44	63	152	212	45	63	56
16	1/00	MBA	32	F	T	C	12	35	83	113	60	37	46
17	1/00	CLA	50	M	R	C	44	37	183	272	50	53	52
18	1/00	PM	38	M	P	C	35	70	141	200	58	62	60
19	1/00	MBA	46	M	R	C	20	33	176	219	58	55	56
20	1/00	MBA	39	M	T	C	51	70	212	260	63	63	63
21	1/00	CLA	27	M	P	C	27	48	182	231	60	46	52
22	1/00	PM	36	M	A	C	46	66	182	253	60	57	58
23	1/00	FM	37	M	P	C	24	56	172	165	55	65	61
24	1/00	PM	35	M	R	C	39	34	148	185	53	63	59
25	1/00	FM	47	M	P	C	27	56	195	223	53	61	58
26	1/00	PM	25	M	T	C	32	62	211	247	53	47	49
27	1/00	PM	26	M	R	C	20	24	60	218	45	55	51
30	1/00	FM	27	M	R	C	7	51	228	249	50	43	46
31	1/01	FM	44	M	T	MM	27	94	181	256	48	84	70
32	1/01	FM	33	M	P	MM	51	63	207	232	55	48	51
33	1/01	MBA	35	M	P	DIME	10	60	184	222	53	45	48
34	1/01	PM	38	M	P	MM	27	39	177	218	52	53	53
35	1/01	CLA	28	F	P	MM	29	58	59	171	54	69	63
36	1/01	PM	45	M	T	MM	22	67	167	216	60	60	60
37	1/01	PM	28	M	P	DIME	29	39	154	215	52	34	41
39	1/01	PM	27	M	R	MM	60	100	196	271	51	69	62
40	1/01	CLA	34	M	R	MM	29	41	152	212	56	45	49
41	1/01	CLA	30	M	P	DIME	35	58	203	223	60	48	53
42	1/01	MBA	22	F	R	DIME	39	56	190	240	57	50	53
43	1/01	PM	40	M	A	MM	12	41	133	202	65	37	48
44	1/01	FM	34	M	T	MM	29	83	145	210	64	57	60
45	1/01	FM	32	M	T	DIME	27	72	166	185	50	49	50
46	1/01	PM	41	M	P	MM	20	67	210	241	54	59	57
47	1/01	PM	33	F	P	MM	27	53	115	185	55	50	52
48	1/01	FM	35	M	P	MM	27	68	159	249	60	64	62
49	1/01	FM	61	M	R	MM	22	45	99	151	56	56	56
50	1/01	PM	24	M	P	DIME	41	92	146	196	71	61	65
51	1/01	FM	44	M	P	DIME	29	75	243	239	66	50	56
53	1/01	MBA	30	M	R	DIME	39	52	192	218	54	44	48
54	1/01	PM	36	M	R/T	MM	15	67	41	255	58	68	64
55	1/01	FM	47	M	T	MM	39	81	222	243	64	72	69
56	1/01	PM	43	M	P	MM	29	71	218	251	70	60	64
57	1/01	PM	36	F	T	MM	17	81	174	218	78	89	85
58	1/01	PM	33	M	P	DIME	41	58	175	261	58	84	74
59	1/01	MBA	22	F	R	DIME	22	53	235	241	58	35	44
60	1/01	PM	26	F	P	DIME	27	47	87	151	54	56	55
61	1/01	PM	45	M	T	DIME	22	61	191	212	52	82	70
62	1/01	CLA	29	F	A	DIME	10	52	80	212	62	34	45
63	1/01	FM	38	M	R	MM	44	41	133	211	55	56	56
64	1/01	PM	45	M	R	MM	26	51	180	243	67	59	62
65	1/01	FM	25	F	R	DIME	39	64	255	269	57	62	60
66	1/01	FM	23	M	T	DIME	29	44	197	226	50	51	51
67	1/01	PM	24	M	R	MM	41	78	149	203	66	56	60
68	1/01	MBA	24	M	R	DIME	22	56	230	243	52	39	44
69	1/01	PM	35	M	P	MM	32	58	193	245	46	48	47
70	1/01	CLA	32	F	P	MM	12	43	134	190	70	61	65
71	1/01	PM	40	M	R	MM	17	41	243	252	46	39	42
72	1/01	PM	35	F	R	MM	17	27	148	175	35	33	34
74	1/01	CLA	52	M	P	MM	20	56	132	195	72	50	59
76	1/01	PM	40	M	A	MM	22	67	225	217	52	50	51
77	1/01	FM	34	M	T	MM	41	41	167	167	65	64	64
78	1/01	PM	34	F	P	MM	15	54	124	176	51	68	61
79	1/01	FM	35	M	P	DIME	15	67	152	199	58	47	51
80	1/01	PM	38	F	R	DIME	37	61	168	224	50	63	58
82	1/01	PM	27	M	A	DIME	12	40	156	201	50	52	51
83	1/01	PM	27	M	R	DIME	12	36	61	120	56	43	48
84	1/01	FM	52	M	R	DIME	49	60	252	226	70	60	64
86	1/01	PM	39	M	A	MM	12	30	222	224	54	56	55
87	1/01	PM	34	M	R	DIME	27	31	177	186	58	53	55
89	1/01	PM	45	M	P	MM	17	44	132	227	40	56	50
90	1/01	FM	40	M	T	MM	27	52	167	218	45	58	53
92	1/01	FM	45	M	P	DIME	20	58	203	234	62	69	66
93	1/01	FM	28	M	P	DIME	29	50	275	299	75	58	65
95	1/01	PM	37	M	R	DIME	17	52	158	201	35	44	40
97	2/01	MBA	27	M	A	MM	10	29	183	225	65	63	64

98	2/01	MBA	34	M	T	DIME	12	61	192	205	54	50	52
99	2/01	CLA	32	M	R	MM	39	54	221	241	58	52	54
101	2/01	MBA	40	M	P	MM	29	46	145	185	51	56	54
103	2/01	MBA	35	M	R	DIME	20	46	203	223	45	50	48
104	2/01	MBA	34	F	P	MM	15	22	164	215	58	52	54
105	2/01	MBA	28	M	T	DIME	5	37	171	243	43	55	50
107	2/01	MBA	25	F	R	MM	15	37	146	189	55	52	53
109	2/01	MBA	32	M	T	MM	49	66	102	151	65	68	67
110	2/01	MBA	29	F	T	MM	5	44	232	239	63	53	57
112	2/01	MBA	40	M	R	DIME	17	27	65	195	40	41	41
114	2/01	MBA	27	F	R	MM	12	49	152	170	72	52	60
115	2/01	MBA	47	F	A	DIME	56	54	140	215	58	66	63
116	2/01	MBA	32	M	R	DIME	22	42	210	215	64	57	60
118	2/01	MBA	26	F	R	MM	24	49	170	154	56	58	57
120	2/01	MBA	45	M	R	DIME	44	61	212	217	72	68	70
121	2/01	MBA	24	F	R	MM	22	44	166	190	50	53	52
123	2/01	MBA	28	M	T	MM	27	32	252	266	53	52	52
124	2/01	MBA	35	M	A	MM	22	32	154	212	52	49	50
125	2/01	MBA	28	F	R	MM	20	61	193	221	58	50	53
126	2/01	MBA	34	F	A	DIME	15	39	184	211	45	58	53

Test A

Item	*n*	PT (X_1) Pre	PT (X_1) Post	MM (X_2) Pre	MM (X_2) Post	DIME^{PM} (X_3) Pre	DIME^{PM} (X_3) Post
		27	27	44	44	33	33
<u>Project Perspectives</u>							
Identify the environmental factors [2]		4.57 *(4)*	5.60 *(5)*	5.08 *(5)*	6.65 *(7)*	5.71 *(6)*	6.78 *(6)*
Translate client requirements [4]		6.00 *(7)*	6.70 *(8)*	5.78 *(7)*	7.18 *(7)*	5.95 *(7)*	7.56 *(7)*
Define goals and objectives [12]		5.91 *(6)*	6.30 *(6)*	5.54 *(7)*	6.94 *(8)*	5.62 *(6)*	7.11 *(7)*
Draft project documents [10]		5.52 *(7)*	6.00 *(7)*	4.66 *(7)*	6.59 *(8)*	4.86 *(6)*	7.33 *(7)*
Prepare a project brief [16]		4.35 *(6)*	5.80 *(7)*	4.20 *(4)*	6.65 *(7)*	5.05 *(4)*	6.78 *(6)*
Satisfy constraints [18]		4.09 *(5)*	5.50 *(7)*	4.08 *(6)*	5.76 *(7)*	4.81 *(5)*	5.89 *(5)*
Develop project brief [19]		5.52 *(6)*	5.90 *(7)*	4.71 *(5)*	6.76 *(7)*	5.52 *(5)*	7.11 *(7)*
Manage client brief [20]		5.61 *(7)*	6.50 *(9)*	5.15 *(5)*	6.88 *(7)*	5.62 *(7)*	7.22 *(7)*
Identify customer wants [34]		5.83 *(5)*	6.70 *(6)*	5.55 *(6)*	6.88 *(7)*	6.35 *(6)*	7.22 *(7)*
Establish a vision of objectives [9]		5.45 *(6)*	6.40 *(7)*	5.12 *(7)*	7.18 *(7)*	6.00 *(7)*	7.11 *(7)*
<u>Tools and Techniques</u>							
Apply techniques and concepts [1]		4.17 *(5)*	6.20 *(6)*	4.34 *(4)*	6.82 *(7)*	5.24 *(7)*	7.22 *(8)*
Prepare Work Breakdown Structure [6]		4.04 *(3)*	6.50 *(6)*	3.58 *(2)*	7.06 *(7)*	4.81 *(5)*	7.00 *(5)*
Use project risk analysis [14]		3.65 *(4)*	4.80 *(6)*	3.54 *(3)*	5.88 *(5)*	4.62 *(6)*	5.33 *(6)*
Implement value management [15]		3.22 *(5)*	4.70 *(6)*	3.07 *(3)*	5.29 *(5)*	4.10 *(5)*	5.33 *(6)*
<u>Interpersonal Skills</u>							
Communicate complex arguments [11]		5.30 *(5)*	6.50 *(6)*	5.00 *(6)*	6.35 *(7)*	4.86 *(5)*	7.00 *(7)*
Get people to achieve goals [13]		5.74 *(6)*	6.60 *(6)*	5.61 *(5)*	6.82 *(6)*	5.86 *(7)*	6.11 *(7)*
Draft written communication [24]		5.78 *(6)*	6.50 *(6)*	5.61 *(6)*	7.06 *(7)*	6.10 *(8)*	7.11 *(7)*
Formulate and present ideas [25]		5.91 *(6)*	6.20 *(5)*	5.37 *(6)*	6.76 *(7)*	5.86 *(6)*	7.56 *(7)*
Deliver verbal communication [26]		5.70 *(5)*	6.20 *(6)*	5.51 *(6)*	6.88 *(7)*	5.90 *(6)*	7.22 *(8)*
Minimise conflict [29]		5.87 *(6)*	6.50 *(6)*	5.38 *(6)*	6.65 *(8)*	6.05 *(7)*	6.44 *(7)*
Integrate teams [30]		5.22 *(5)*	6.10 *(7)*	4.85 *(6)*	6.47 *(6)*	5.70 *(6)*	6.78 *(7)*
Delegate project work to others [31]		5.43 *(6)*	6.20 *(6)*	5.65 *(6)*	7.12 *(7)*	5.80 *(6)*	7.00 *(7)*
Resolve conflict in projects [32]		5.83 *(6)*	6.20 *(7)*	5.68 *(6)*	6.53 *(7)*	6.00 *(6)*	6.44 *(6)*
<u>Operational Plan</u>							
Prepare a strategic plan [3]		5.00 *(5)*	5.90 *(7)*	4.56 *(6)*	6.94 *(7)*	5.19 *(7)*	7.33 *(7)*
Establish a range of organisations [5]		4.27 *(4)*	5.10 *(5)*	3.85 *(5)*	5.82 *(7)*	4.95 *(5)*	6.44 *(7)*
Plan the stages of a major project [7]		4.57 *(6)*	6.30 *(7)*	4.09 *(4)*	7.00 *(7)*	5.43 *(6)*	6.67 *(7)*
Draft a framework [8]		4.27 *(3)*	5.70 *(5)*	4.00 *(5)*	6.47 *(7)*	5.00 *(5)*	6.56 *(7)*
Advise options for allocating risk [17]		4.52 *(5)*	5.30 *(6)*	4.05 *(6)*	5.53 *(6)*	4.38 *(4)*	5.67 *(5)*
Develop a procurement strategy [21]		5.05 *(5)*	5.90 *(6)*	4.61 *(4)*	6.65 *(6)*	5.29 *(6)*	7.11 *(7)*
Define the structure of project team [22]		5.70 *(7)*	6.80 *(7)*	5.05 *(6)*	6.76 *(7)*	6.05 *(6)*	7.22 *(7)*
Define roles and responsibilities [23]		6.04 *(7)*	6.90 *(8)*	5.68 *(7)*	7.29 *(7)*	6.52 *(7)*	7.22 *(7)*
Determine the duties in law [27]		5.26 *(6)*	6.00 *(7)*	4.76 *(5)*	5.59 *(6)*	4.85 *(5)*	5.44 *(6)*
Advise upon forms of contract [28]		5.00 *(5)*	5.70 *(6)*	4.78 *(4)*	5.65 *(6)*	5.05 *(6)*	6.33 *(6)*
Prepare contract documentation [33]		5.43 *(6)*	5.70 *(6)*	4.44 *(4)*	5.82 *(6)*	5.25 *(5)*	6.11 *(6)*

[ ] item reference on self-efficacy rating scale distributed to students
( ) mode

Mean (mode) pre and post self-efficacy ratings

Project: In-company evaluation **User:** Administrator **Date:** 23/04/01 - 17:59:37

DOCUMENT TEXT REPORT

Document: JG

Created: 23/04/01 - 17:58:44
Modified: 23/04/01 - 17:59:09
Description: Interview with JG - dated 11th April, 2001 at [the company] head office

Document Text:

1: **Interview with JG - dated 11th April, 2001 at [the company] head office**
2: The first question John then is were you conversant with the material on the CD-ROM?
3: Yes, most of it I was already conversant with. I mean the case studies obviously were all new and there are some elements of material were new of course, the majority of it I knew.
4: Having said that then, was it factually correct?
5: Yes as far as I could make out. I would say I thought it was light on a cultural organisation structure but that was just the area I looked at. I think for the basics of project management and what was needed, everything was there and the information appertaining to it was factually correct.
6: So was that content relevant to your job?
7: As a project manager? Yes I must say. It's a question of how much information is appropriate and what I think it provided was a very good framework, a skeleton of what's needed. I don't think it provides everything and I think there are nuances and variations that might perhaps be explored as you develop it, but you're looking at and trying to gauge the audience that you're applying it to and you've got to reach the average rather than a specific audience.
8: Well the audience here is [the company]- that being the case then I really just want to try and gauge your reaction to whether you see training as having to be directly relevant to your workplace role or whether you see the training offered by the organisation should be broader than that?
9: There are a number of possibilities. Training has to be cost effective to any organisation so, in other words, if you are paying either in terms of time or in terms of money or in terms of back up of the organisation to increase the skills and confidences of individuals within that organisation, you're doing it to further the business aims of the organisation and that means either productivity, profitability and greater client rates - it's got to have some means of reflecting on the balance sheet at the end of the day. Otherwise there's no point in doing it. It's worth doing from an individual's point of view obviously because an individual increasing their capacity to understand and learn, they benefit anyway but from an organisational perspective it has to come onto the balance sheet.
10: What about your personal perspective?
11: Well my view would be that you have to have the resources within the organisation to meet the requirements of that organisation, what it's trying to achieve to meet to requirements of the client base or the sector areas that the business is trying to develop

into and you do that by developing your resource to meet it. You can either buy that resource or you can develop what you've already got.

12: You mentioned about the structure and you said that the structure can be divided into project perspectives, tools and techniques, interpersonal skills and a project ... at the end of it. Is that the way you would categorise project management?

13: No, but I think I categorise project management as a more chaotic structure which is what real life is, so project management comprises elements of all these things and the way that you arbitrarily provide a boundary between each of the subject matters is very much whether that is the most important way for somebody to understand it. How then it is mixed in the cookery book of real world afterwards is very much the next stage of the understanding isn't it; and to a certain extent the case studies help with that although they obviously have to be made a bit more simplistic than they actually occurred - but what real life is about is understanding the blurred grey areas around all the things that you teach and the people then have to apply experience to be able to understand that. Project management is about trying to apply structure to chaos and that human nature is about trying to organise individuals into groups to achieve higher order objectives. So as a single person say for instance, there's an analogy you can look about a kitchen and bake a cake and everyone will bake it slightly differently. When you come to organise larger numbers of people and bigger projects there has to be some sort of framework behind it to prevent chaos ensuing and that's the hard element of the job, but equally there has to be as much of an understanding of the lubrication needed to ensure that people can work within a framework and to ensure that efficiency and objectives can be met, and that's the soft side of it and they're both equally as important and the balance between the two varies between the individuals who are being used and between the projects which are being worked on, because they're all different and that's the area that I saw you're a bit light on. Organisation, culture and structure because the culture of projects is different it depends on the client, depends on the organisation providing the services and the structure is always different because people have different ways of viewing things, so much was made of matrix analogies, you've got autonomous work groups, you've got all sorts of other management theories that sit around that and if you wanted to it can go on for ever. But you have to start somewhere and I think the level that this particular learning exercise is pitched at is appropriate for graduates.

14: Right, right, that's great. As far as the design itself the CD-ROM to help you really to help you work, simple things like the text on a page was the balance right between the amount of text you see or the graphics that there were, or video clips, how do you feel about that?

15: I thought the amount of text on a page was low but that the backup of the information provided alongside it was fine although the balance varied from section to section and it wasn't consistent across the topics. For instance, you had more references for certain sections than others. Equally you had more, shall be call it interactive exercises in certain sections than others and the only comment I had on that really from the purpose of learning was, one you couldn't pull multiple pages up at once and if you think about how you would learn without the CD gadgetry that we now have, if you were using books, you'd have a number of reference texts open, you'd be able to flick between them, backwards and forwards and I felt that facility was missing. So the facility to have multiple pages open at one time. The amount of text that was on the screen was small; but

I felt that was beneficial because one of the problems I think with computer learning, as with all word processing activities is, that the eye doesn't see what's on the screen. If you are looking at a piece of paper you can see the entire page and you get a complete vision of everything that's on the page. When you look at it on a computer screen for whatever reason you don't get that same perspective. So, the fact it was broken down into smaller elements helps in that respect but equally you were only pulling bits off, so it needed a lot of flicking backwards and forwards between roll and sections to get a feel for a total entity and that's why I was saying multiple panes might help in that respect and I felt that aspect of it was missing.

16: Were you allowed to navigate through as fluidly as you would have wanted to or did they hinder you?

17: I felt it was more "clunky" than it might have been. The analogy I would make was that if you had a tabular system as if it were in a book and that you could go back to the tab to a particular section and then just page through it as you needed. I would have preferred something like that but probably that's me being old-fashioned. The system as it stood was useful but you didn't have page numbers, you had the key in the middle of the dial, but the numbering system wasn't consistent so you went from section to section - you might have only two pages in that section and 16 in the next and again if you were trying to navigate between one section and another I found that more of a hindrance really. The Microsoft features when they use something like that and they are always tabular based, you have a little tab for against each section and you can tab between them and you can do that on menus for that matter, if you just flick between manual page or back to the tabulated chapter headings as needed and then just flick through pages as you need to go through them. But I think that's just my point of view.

18: Moving on a little bit towards you then, and your feelings on the matter of computer aided learning. Put bluntly, if you had a book and you had a CD-ROM, which would you choose?

19: The book.

20: Right. Why would that be?

21: I find it easier to reference. As I said before, you can flick through a book without problems and you can do it quickly. You can skim-read a book quickly, it's more difficult on a CD-ROM, because you have to flick through the screens. You can multi-reference much more easily, so you can keep your thumb or fingers in various pages and just flick backwards and forwards and it's like the issue of why have CD-ROMs never taken over as book-based text and they haven't because it's not convenient - because you can't see a single page on a screen - because you can't see everything at once and people just found them not as convenient. Whether that is a truism or not I'm not sure but I prefer a book.

22: It's your opinion that I value here and therefore if you say what you feel about it.

23: I think the advantage a CD-ROM does have over a book is where you have external links and one of the things I've found quite useful here was that you could pull up the references or examples and the interactive things. That's something you cannot get in a book so that's something CD-ROM provides an advantage and also the web links which you obviously can't get in a book either. They were quite useful but on balance I prefer a book. I have undertaken distance learning in the past and the way that's been based is a mixture and I find that quite beneficial. So for instance a CD-ROM might contain the things like video clips and references which would otherwise be difficult but you still

have text-based structure to a learning process as well.
24: Thinking more now if you like, from a company point of view. Did you get 15 hours to do the evaluation?
25: You mean were 15 hours available during a normal working day? No.
26: Why was that the case?
27: Well during a normal working day you've got your job to do and the difficulty is to break off and try and do distance learning - you need a period of reflectivity as well. You cannot just do it in bits, so you've got to give a period. If you're working in project management the sort of office we work in, the phone is going continuously, you've got people coming to see you continuously. The only way you can really make time is to do it outside office hours and that would be normal.
28: So that's not really a matter of [the company] per se, it's really to do with ...?
29: I think that's industry-wide.
30: Is it your intention to do anymore training or academic qualifications?
31: Probably yes, but that's something I still have to think about.
32: What I'm trying to get to in there is not wanting to quiz as to what you might want to do but do you think conditions, in work or away would change - the evaluation being rather a small scale, an informal approach perhaps. Is it something you want to do in work?
33: I would always want to do formal working outside work. I wouldn't want to do it in work, there are too many distractions. I think it's different if say for instance, if there was a policy decision taken for a graduate training programme. They were given half a day a week to sit down and do something, but there again you're forcing people to learn which might not be convenient to them and I think if people wish to learn it's something they should want to do themselves and make the time available to do it, and how best they do that is up to them.
34: You say you have experience of distance learning and I guess you have experience of traditional learning as well. Which of the two do you prefer?
35: Face to face because you have a lot more social contact. You learn by taking in all the senses and if you do it by distance learning you are only using some of them and the problem with distance learning is getting feedback at the time you are trying to understand the issues. There are two elements. You need to understand at the time your learning and you need to understand at the time your reflecting of what you've - and learnt so the two are different. Distance learning allows you to reflect after the event but not to ask the questions as easily. The disadvantage is that when you're going through distance learning and doing it by yourself and you're going through the information presented, at the time there is only you to adjudicate on whether or not the points that you're picking up are the points that you will be expected to understand from the information presented. That was one of the other comments I had on this that's feedback, but if you are reading text you can read through it and you can think you've understood it, the only way you will know you've understood it is when someone questions you on it and therefore the points of learning that you might get out of it on first reading are what you assume them to be but very often with a little bit more guidance on what the other points of learning might be as well and in that sense I thought it might have been useful if after similar sections there were questions so that people read and then go to the questions which aren't assessed - but they then know whether or not they've understood what

they've read in the context on which the questions are made.

36: Thank you. At work, do you use the internet?

37: Yes.

38: What do you use it for?

39: Research and also for technical queries. We have the internet-based technical index system which allows us to access things like British Standards and design codes and things of that sort but we also use it for more general checks, say for instance when we put tenders in to get background information or to get information from government sites and statistics, publications and things like that.

40: And do you feel that the organisations is happy for you to freely use the internet as you will?

41: Yes, I mean the organisation has policy on this and it's more than happy that the internet is used for business purposes, what it's not happy with and which I concur, is that it's used for personal purposes ie, not business purposes, say for instance if you've surfing the 'sex sites' on the internet.

42: Is there any check on that if that's the case?

43: Yes. The way the system operates is that the history record of the sites that have been logged into cannot be erased and therefore all available to be checked by IT. I hesitate to add you're allowed to use it for personal purposes outside office hours, which I think is a reasonable balance. So you're saying we're not trying to be restrictive about, sorry Draconian about it, we're not trying to stop people using it. If you're using it for personal purposes, do so outside office hours.

44: Now I know from your email that you must have been trying to access the website so moving onto that.

45: The website I've found quite useful not so much in the fact that you had all files to download but you had access to related sites with other information on, and in fact I used the search engine on the DTI website which was easier to use than just hacking into and browsing the system. But generally it's offering another facility for alternative sources of information for widening the scope and I think that's fine. I think if it was being used in a non-works environment and obviously that's something else that people have to consider because it has to be paid for by the firm, but I find it a useful facility. Things like being able to ask email questions are fine, but I find emails very impersonal and don't particularly like them. People tend to think of them as an easy method of conversation but it's not because there's a time delay on it and you cannot chat with a time delay, it's like trying to introduce a 10 second delay in a transatlantic telephone conversation.

46: There was no evidence of people having used the real time communication.

47: I couldn't get into a site where real time conversation was taking place, I thought you'd automatically be restricted us to the people who were taking part in the test.

48: I imagined the people would actually use that facility in [the company] but I didn't restrict it ..

49: Right. It's not the same though because you've that much input coming into it, it's like trying to hold a multi-way telephone conversation with a number of people, it isn't the same and that's another aspect altogether. If you're sat round a table discussing something you can see what's happening, you can see who's about to talk, who's thinking, who's not talking. When you only have voice or text obviously you can't see that and it prevents the full communication process - but that's just the personal choice.

50: Did you need any assistance to get the thing up and running?
51: No, apart from the password that I needed, but I sorted that one out, and that was all.
52: Did you use the computers here at WYG or did you use your own?
53: I used it here.
54: So was the hardware capable of running everything?
55: Yes more or less. There's a problem with NT which it the system it operates on. My computer doesn't quite have all the features but that's all, it's relatively minor.
56: There was a need for one or two downloads you know to get things running for example the panoramic movie, which I was conscious of, the download on quick time and so forth, is that normally on the system or is that something people would have to download? Can you download it? Have you those rights to download?
57: No, because of the possibility of viruses but it's relatively easy to get those sort of things from our IT people, it's not an issue. What I would say about the video movies is they were on a small screen, two inches square and I think the problem with that is, whilst that is normally the way videos run on these clips, when you're actually looking at it, it doesn't' come across particularly well especially people in this generation used to wide TV screens.
58: You had sound cards etc?
59: Yes we had all that.
60: Did you then find, you had the hardware support, did you find it was slow, or quick or..?
61: No, it was fairly quick. Occasionally when it takes a little while for menus to regenerate off the CD that sort of thing, you tend to get a bit itchy about it, but that was all.
62: Well that covers my points so I'd like it to be more open house here I said they were open interviews though it was necessary at least I covered some of the basics there, but I'd like to cover some of the gaps really from a learners point of view about the CD.
63: I found it quite useful, the information that's on there is refreshments for some of the issues and it's nice to play around with interactive displays on Belbin to modify your personal profiles so you don't come across quite as Jekyll and Hyde. And the case studies at the end were interesting as well because although I was aware of some of the project I wasn't aware of all of them. It's nice to see what happens in other areas. But I don't think apart from that I have any other real comments. It was an exercise that was worth doing and it was nice to see the information presented in that format because we employ graduates and it certainly gives you a better idea of perhaps how to take graduates through the stages of getting used to project management because they don't all come in with project management qualifications or a project management background.
64: OK, well that's it unless you have any comments to add to that.
65: Not really.
66: Thank you very much.
